The Journal of Periodontology
is dedicated to
Dr. Gillette Hayden
and
Dr. Grace Rogers Spalding
for their pioneer efforts and
selfless devotion in behalf
of periodontia and the
American Academy
of Periodontology

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THE JOURNAL OF PERIODONTOLOGY

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THE JOURNAL OF PERIODONTOLOGY is published to serve as the professional journal of periodontia; to keep dentists in touch with research being carried on in this field and related sciences; to stimulate greater interest in the supporting tissues of the teeth and their relation to oral and general health.

The Journal is the official organ of the American Academy of Periodontology and will contain, therefore, papers of scientific and clinical interest which are presented at the annual meetings of that society, as well as articles submitted direct to the Editor. Obviously opinions expressed do not necessarily represent those of the Editor or the American Academy of Periodontology.

Thirty-seventh Annual Meeting

THE AMERICAN ACADEMY OF PERIODONTOLOGY

September 24, 25 and 26, 1953

Cleveland, Ohio

Annual Spring Seminar

April 27, 28, 29, 1953

Ann Arbor, Michigan

Grace Rogers Spalding

1881-1953

THERE is a vacant place in the ranks of the American Academy of Periodontology and an aching void in the hearts of its members. Grace Rogers Spalding died January 7, 1953 after a long illness which she endured with the fortitude so characteristic of her. Her presence, her council, her vision, which played so large a part in the organization and progress of the Academy will be sorely missed. Few if any of its members have made a greater contribution to the advancement of periodontology.

To her leadership, with the active cooperation of Dr. Gillette Hayden, belongs the credit for the conception and organization of the American Academy of Periodontology. Beginning with a membership of eighteen, seven of whom were women, Dr. Spalding gave to the newly formed organization a life-long devotion. This she did as Secretary 1918-19, as a member of the Council for several years,

as its President in 1923, and as Editor of its Journal for twenty years, retiring from its exacting duties only after the condition of her health made that necessary.

Every honor within the province of the Academy was bestowed upon her: Fellowship, given to but few; the Scroll of Honor at the 25th Anniversary meeting in 1938, plus the affection and esteem of every member.

Grace Rogers Spalding meant vastly more to those who knew her than the sum total of her accomplishment—more than all the honors which were so deservedly bestowed upon her. There was that indefinable element in Dr. Spalding which set her apart from the rank and file of her coworkers. She was by nature, progressive—one who could never be satisfied with the status quo. She believed in a better tomorrow. Hers was the gift of vision—the ability to see, as it were, the invisible.

Dr. Spalding was unselfish. No sacrifice, no burning of the midnight oil, was too high a price to pay, if the task was one that needed to be done, and if in the doing of it, the profession, which meant so much to her, would thereby be able to serve more acceptably.

Dr. Spalding was an idealist. Her standards were high. The Golden Rule held first place in her personal and professional activities. Under her editorship the Journal of Periodontology came to be recognized as an example of what a professional journal could be; no advertisements to mar its pages; no unworthy contributions given a place between its covers.

Above and beyond these attributes were those innate qualities of heart and mind which endeared Dr. Spalding to all who knew her—who voluntarily took upon herself responsibilities which entailed endless sacrifices, and in so doing was able to render a service "above and beyond the call of duty."

This is the Grace Rogers Spalding whom we knew—one who gave freely of herself to the advancement of her profession and to the enrichment of life.

A. H. M.

With the death of Dr. Grace Rogers Spalding on January 7th, the dental profession lost a pioneer dental specialist—a leader in the growth of Periodontics.

Born in Archbold, Ohio, Dr. Spalding attended Toledo High School after which she attended the University of Michigan Dental College where she received her D.D.S. degree with the class of 1904. She also augmented her basic training by post graduate work in the medical college of the University of Michigan.

Dr. Spalding was one of the founders of the Academy of Periodontology in 1914. She served as president of the Academy and was later named a Fellow of the organization.

Dr. Spalding served as director of the Preventive Section of the Detroit Dental

Clinic Club from 1917 to 1927 and the Periodontic Section from 1931 to 1934, being president for two years and elected to Honorary membership in 1935.

She was one of the organizers and the first chairman of the Detroit Dental Aid Commission of the Detroit District Dental Society.

Dr. Spalding was one of the first women to be elected to membership in the American College of Dentists.

She was a member of the American Association of Dental Editors for several years. In 1930 she established and edited for 20 years The Journal of Periodontology. She received an honorary testimonial from the academy. In 1926 she was Secretary of the Periodontology section of the International Dental Congress held in Philadelphia.

Grace Spalding retained her modest, effeminate personality throughout her professional career. She was a devoted wife and mother.

Her name is listed in "Who's Who of American Women."

Dr. Spalding married Dr. Edward Spalding in 1910. She practiced in Detroit from 1904 to 1924 and was associated with her husband in offices on West Maple Ave., Birmingham, since 1924 and resided at 6890 Commerce Rd., Green Lake.

Beside her husband, she is survived by a daughter, Mrs. Winston T. Ely of Green Lake and three grandchildren.* *O. W. W.*

The death of Dr. Grace Rogers Spalding is an inestimable loss to the Academy of Periodontology. From the history that I gather from her contemporaries that have known her and are familiar with her work since she graduated from dental school, she was one of the principal moving spirits in organizing the Academy in 1914 at a time when periodontology was frowned upon by the majority of the members of the profession. She was among the first members of the profession to appreciate periodontology and to realize that the care of the gums and supporting structures of the teeth was as much a responsibility of the profession as that of filling teeth and making prosthetic appliances. This was a new concept and one that Dr. Grace seemed to devote her life to. She lived to see this new concept accepted and periodontology well established as an important branch of dentistry.

After the Academy was well established, it became evident to the leading members that an official organ of the Academy was needed, the purpose of which would be to record the history of Periodontology, disseminate information regarding the subject and to interest more dentists in this field. Dr. Grace was one of the leaders in establishing the Journal in 1929 and was chosen as its first editor. She occupied this position until her retirement in 1949 on account of ill health. Before 1929 scarcely any of the dental journals gave specific attention to Perio-

*Reprinted from the Michigan State Dental Journal, **22**:13 (1953).

dontology. From this date on Dr. Grace devoted the major portion of her life to nurturing and developing the Journal.

It was only through her devotion, determination and personal sacrifices that the Journal survived the depression years of the early thirties. She not only gave of her time but she actually gave of her personal finances to keep the Journal going. After the latter sacrifice was learned by other members of the Academy, there was immediately started a movement to raise funds by personal subscription to the Journal fund. It was these funds influenced by the personal sacrifices of Dr. Grace that allowed the Journal to survive. It was her pioneering spirit that made the Journal what it is today as well as playing an important role in the development and success of the Academy.

Since 1927 it has been my privilege to be associated with Dr. Grace in a variety of personal and professional relationships. I have never known a more genuine, loyal and altruistic woman. All who knew her had for her a profound respect, admiration and affection. She made a deep and lasting impression upon my life as I am sure she made upon everyone that knew her. She was a great benefactor of mankind. Though she has left us, her spirit and contributions will live on forever. *Roy O. Elam, President.*

Now, even more than during her lifetime, the shadow cast by the passing of Doctor Grace Rogers Spalding brings closer to us all how great is the loss to our profession, and in particular, our own Journal of the American Academy of Periodontology. As these words are written, it is so clear that Doctor Spalding stood for and as steadfastly fought for her ideals. She did not swerve in the face of opposition from her beliefs or ideals.

One of the great interests in Doctor Spalding's life was the Journal. While Doctor Gracey was Secretary and Treasurer of the Academy, and later, during my tenure of office from 1936-1946, our membership remained small, and at times, we faced problems in keeping the Journal on a sound financial footing. This difficulty raised the question of the sale of advertisements in order to keep the Journal going. Another possible solution concerned the feasibility of turning the Journal over to a publishing house, with the consequent loss of independence in its editorial policy. Both of these expedients Doctor Spalding bitterly opposed. The Journal had already proven itself and was being recognized as one of the finest publications in Dentistry. Doctor Spalding remained determined that the Journal should never compromise or give up its birthright.

On many occasions I had the pleasure of calling at Doctor Grace's offices where she edited the Journal. Not many Academy members have ever realized the many hours she spent over the years in the interest of this Journal. When it became necessary, even the task of mailing a copy to each subscriber was not too much. From Volume 1, Number 1, the Journal was her pride and joy; she drew

strength and satisfaction from its progress and success until ill health forced her to retire in 1949.

The story of the Journal, like many worthwhile enterprises, goes back to a small beginning and a period beset with difficulties. Now, the Journal endowment fund, established several years ago, exceeds $17,000. This achievement is the result of generous contributions to this fund by many members and recently, by a bequest of $10,000 made by the late Doctor Walter H. Scherer. We can all nod our heads with thanks and quiet satisfaction that Doctor Spalding's dream is now a reality. An association with Doctor Spalding over past years has made it possible to know and understand how great was her concern for the future of the Journal of Periodontology.

These comments are offered, not only out of a desire to express our appreciation of one of Doctor Spalding's achievements, but also by way of re-stating our determination that her beloved Journal shall continue as a publication of increasing value and service to our profession and to the members of our Academy. *Raymond E. Johnson, Treasurer.*

Grace Rogers Spalding, the Academy's most unforgettable member. To know her and talk with her was inspiring. I recall the seminars of the Academy held at the Kellogg Institute of the University of Michigan at Ann Arbor which she never failed to attend. These seminars were always held in the spring of the year, and at recess intervals the few members in attendance would sit on the steps admiring the spring foliage and have little chats. Here Grace Rogers Spalding told me of her early experience in periodontia. It was just as if it came out of a prize winning story book. She was so modest, it was only by continual questioning that I obtained the more fascinating parts of her experience.

With it all, again and again and with much feeling, she gave credit to her husband, Edward G. Spalding, for persuading her to go into the specialty of periodontia. The dental profession owes a great and lasting debt of gratitude to this pioneer in our special field. Not only was she a successful editor and practitioner but a dutiful, capable and lovable wife and mother. She was always interested in her family, her Journal and her profession. *J. Aiguier.*

With feelings of deepest regret the American Academy of Periodontology records the passing of Dr. Grace Rogers Spalding.

We realize to the fullest extent the benefits our organization has derived from her ability, loyalty and devotion to the profession.

The present status of Periodontia is largely due to her vision and unceasing interest.—*Hunter S. Allen.*

THE JOURNAL OF PERIODONTOLOGY

APRIL, NINETEEN HUNDRED FIFTY-THREE

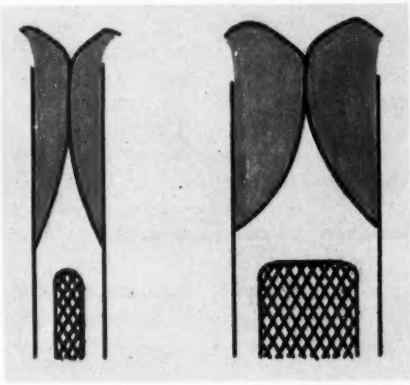
The Crests of the Interdental Alveolar Septa*

by BERYL RITCHEY AND BALINT ORBAN,** *Colorado Springs, Colorado*

CORRECT interpretation of good roentgenograms may provide valuable information in the diagnostic phase of periodontology. The purpose of this paper is to focus attention upon the interpretation of roentgenograms of the crests of the interdental alveolar septa by describing and discussing the effects of: (1) variations in the anatomy and positions of the teeth, (2) the common disease states, and (3) disharmonies in occlusion. The material consists of roentgenograms and histologic slides.

TOOTH ANATOMY AND TOOTH POSITION

The variations in tooth anatomy and tooth position that influence the contour of the interdental septa may be considered in three groups: the shape and the size of the crowns of the teeth, the state of eruption, and position of the teeth in the jaws.



A B

Fig. 1. Effect of tooth form. A. Relatively flat proximal tooth surfaces and narrow septum. B. Wide flat crest in presence of extremely convex tooth surfaces.

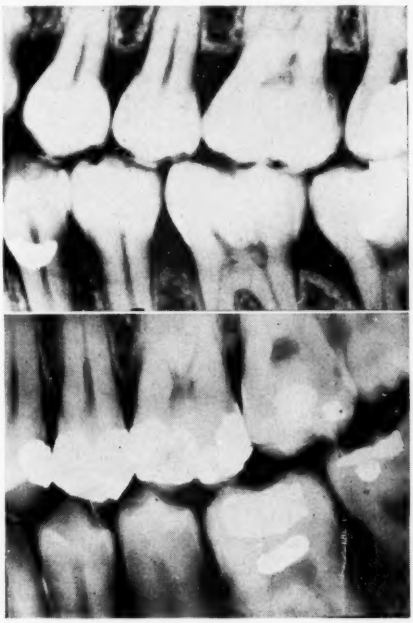


Fig. 2. Influence of the form of proximal tooth surfaces on the width of alveolar crests.
Upper: Convex.
Lower: Flat. As result of a difference in crown size the crest slants upward from long crown of mandibular first molar to cemento-enamel junction of the shorter second molar.

The diagrams in Fig. 1 illustrate a variation in the profile of the interdental crest that is governed by the shape of the teeth. If approximating tooth surfaces are relatively flat, the septa must of necessity be narrow and the crests more or less pointed (A). If mesial and distal tooth surfaces are

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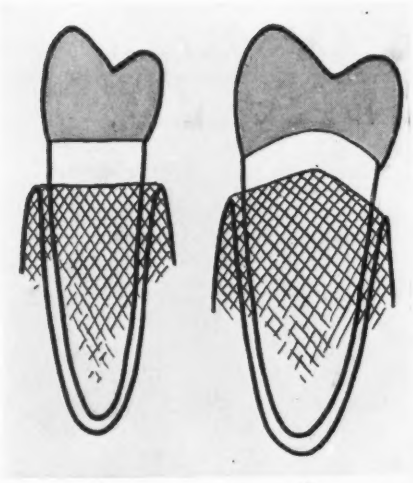
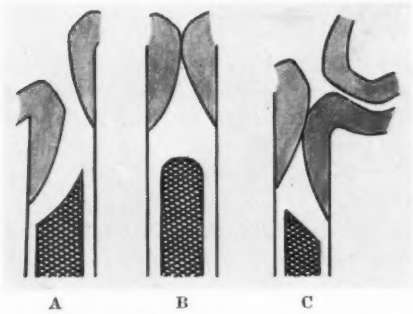
**From the Colorado Dental Foundation, 629 North Nevada Avenue, Colorado Springs, Colorado.



A B

Fig. 3. Variations in bucco-lingual width and the contour of the cemento-enamel junction. Though less in mass of bone the crest in sketch on left might present a more opaque roentgenographic appearance than would the heavier but peaked crest in sketch on right.

strongly convex the interdental septa will be wide and the crests flat (B). Roentgenographic examples of this variation are shown in Fig. 2. The convex maxillary teeth in the upper illustration (A) are supported by wide columns of interdental bone. The alveolar crests between the maxillary teeth in the lower illustration (B) are relatively narrow because of the less highly contoured crowns.



A B C

Fig. 4. Configuration of the alveolar crest as it is governed by the state of eruption. Left: Under eruption. Center: Normal eruption. Right: Over eruption.

Fig. 5. Photomigrogram showing the position of the alveolar crest between an erupted first molar and an erupting second bicuspid. Active bone formation at X on the distal of the erupting bicuspid.

A difference in the length of the crowns of adjoining teeth, whose occlusal surfaces are in the same plane, produces a bony profile as shown between the first and second mandibular molars in B of Fig. 2. In this example the crest must slant upward from the cemento-enamel junction of the long crown of the first molar toward the cemento-enamel junction of the shorter crown of the second molar.

The opaqueness of the roentgen shadow of a crest is influenced by the bucco-lingual width of the teeth, by the contour of the cemento-enamel junction, and by the angle of roentgen ray projection. These factors have been diagramed in Fig. 3. The greater the bucco-lingual dimension of the teeth the greater will be the width of the interdental bone, but projection of X-rays parallel with the surface of the narrower crest (A) would result in a more opaque shadow than would any projection through the wider but curved crest (B).

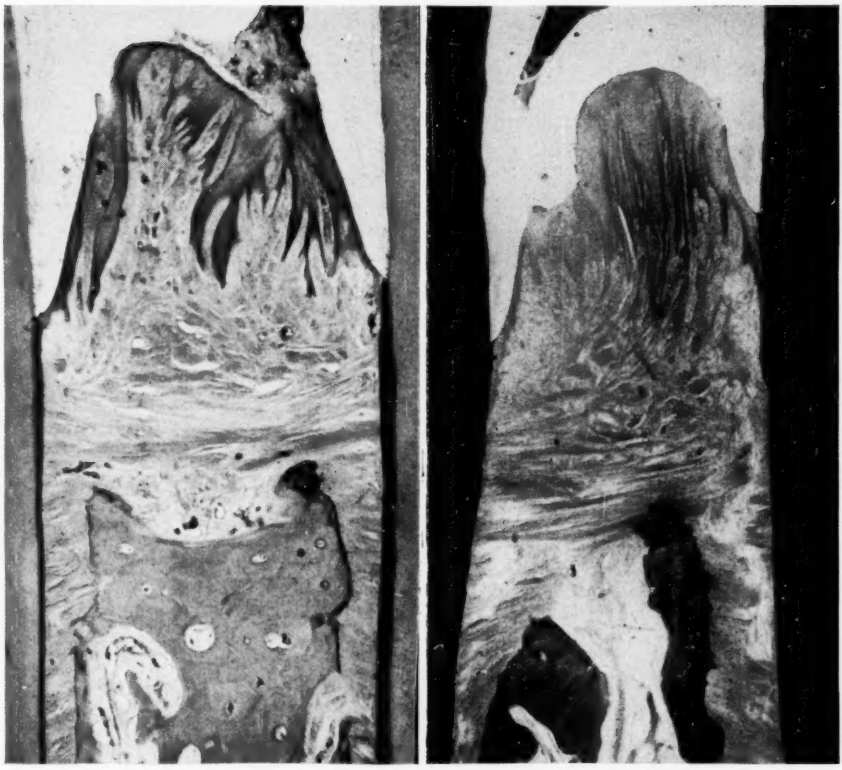


Fig. 6. Fig. 7.

Fig. 6. Photomicrogram showing the relation of the cemento-enamel junctions and the interproximal alveolar crest between two teeth of equal crown size and site of eruption.
Fig. 7. Photomicrogram showing the relation of alveolar crest and cemento-enamel junctions in a case of over eruption of the tooth on the right side.

The second variation that influences the outline of the interdental septa and their crests is the state of eruption. The drawings in Fig. 4 illustrate the profile of an interdental crest during eruption (A), at completed eruption (B), and in overeruption due to the absence of an opposing tooth (C).

Histologic material is readily available for the study of variations in crest contour as governed by the state of eruption. The alveolar crest adjoining any erupting tooth will appear similar to that shown in Fig. 5; new bone (X) may always be observed near the level of the cemento-enamel junction of an erupting tooth. As shown in Fig. 6, equal eruption of teeth of comparable size results in a bone crest that is a relatively straight line slightly below and parallel with a line connecting the cemento-enamel junctions. Rarely do we see a dentition in which crown lengths and height of eruption are uniform; nearly any set of intraoral films will exhibit the crest and cemento-enamel junction relation shown in Fig. 7.

Erupting teeth exhibit roentgen findings that are in conformity with the histologic material. In the upper illustration in Fig. 8 both the second bicuspid and the

Fig. 8. Roentgenograms showing alveolar crest profiles as related to the state of tooth eruption. Top: Erupting second bicuspid and second molar. Center: Over erupted third molar. Bottom: Uneven eruption and unequal crown length.

second molar present examples typical of the alveolar crest during eruption. The illustration in the center of this figure shows the alteration in crest profile to be expected in overeruption. The lower illustration demonstrates the appearance of the alveolar crest in cases of unequal crown length and in uneven eruption. In all cases the position of the crest is dictated by the relative positions of the cemento-enamel junctions. The illustrations in Fig. 9 are from roentgenograms of the same patient, taken at an interval of two years—the upper one just prior to the loss of the maxillary second molar and the lower one two years following removal of the tooth. The formerly horizontal crest between the mandibular molars is now slanting obliquely upward toward the over-erupted second molar. The outline of the original crest is still visible.

The third variation to which we wish to call attention is that of the inclination of the teeth in the jaws. As illustrated by the drawings in Fig. 10, any inclination of the long axes of the teeth results in a difference in the levels of the mesial and distal cemento-enamel junctions and produces

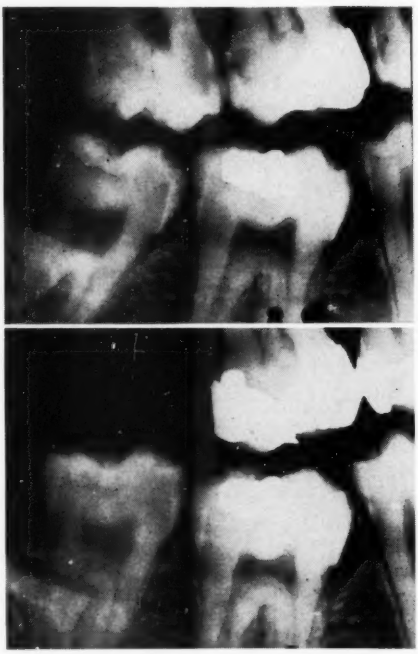


Fig. 9. Roentgenograms showing change from a horizontal (top) to an oblique (lower) alveolar crest between mandibular molars that occurred within two years after loss of maxillary second molar. Note also erupted mandibular second bicuspid.

Fig. 10. Diagrammatic illustration of the influence of tooth inclination upon the alveolar crests.
Left: Horizontal crests when teeth are placed vertically.
Right: Oblique crests whenever teeth present a deviation from the vertical in their long axes; this effect is produced by the relative positions of the cemento-enamel junctions.

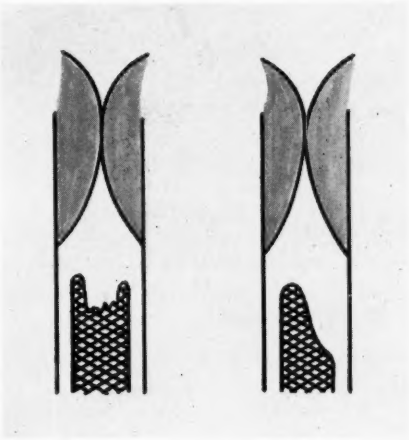
oblique alveolar crests. The illustration in Fig. 11 shows the alveolar crest pattern that is to be expected in a healthy mouth with teeth inclined mesially; the crests are approximately parallel with imaginary lines connecting the cemento-enamel junctions.

Fig. 11. Roentgenogram showing the shape of the alveolar crests and the cemento-enamel junctions in a twenty year old individual with a mesial inclination of the teeth.

THE ALVEOLAR CREST IN DISEASE STATES

Alterations of interdental alveolar crests by the most common disease states are such frequent findings that the characteristic roentgen evidence of inflammatory and degenerative changes should always be kept in mind when interpreting roentgenograms of these areas.

The diagrams in Fig. 12 are believed to be representative of the resorption patterns of inflammation and of degeneration in the alveolar crest area. There is well-founded histologic evidence upon which to prepare such drawings.[1,2,3] The scalloped crest (A) is in keeping with microscopic findings of inflammatory alveolar resorption. The extensive loss of bone, often involving but one side of an interdental column (B), is representative of the histologic picture of degenerative processes in the supporting tissues (Periodontosis).



A B

Fig. 12. Diagrammatic illustration of typical changes in alveolar crest profile in an inflammatory response (left) (periodontitis), and as a result of a degenerative disease (right) periodontosis).

The extension of an inflammatory reaction along the course of the interdental canals has been thoroughly studied,[1] and the roentgen appearance of such lesions is familiar to every periodontist. The roentgenogram reproduced in Fig. 13 is believed to be typical of crest resorption produced by inflammation.

A good roentgenogram is a valuable diagnostic aid, but, regardless of the quality of the film, the presence of a radiopaque

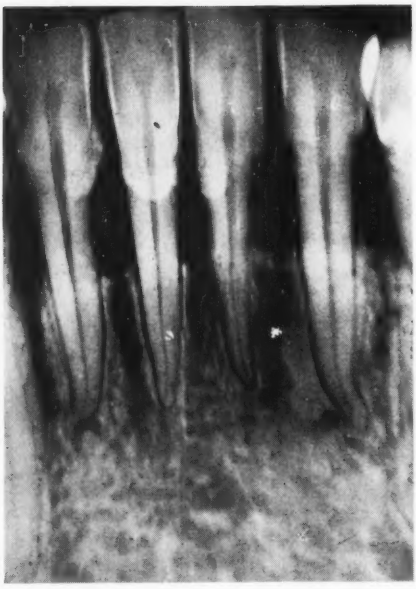


Fig. 13. Roentgenogram presenting the cup-shaped resorption of the alveolar crests and the widening of the interdental canals commnoly associated with inflammation (periodontitis).

alveolar crest should not tempt one to omit the clinical examination. Figures 14 and 15 are included in this series to demonstrate histologic evidence of a severe inflammation coexistent with a heavy alveolar crest and active osteogenesis. A roentgenogram of such an area would give evidence of a radiopaque alveolar crest corresponding to the well-calcified bone (a) of Figures 14 and 15, but would give no indication of the presence of the uncalcified (osteoid) and immature bone forming the tip of the crest (b and c) in Fig. 15. A visual inspection of the gingiva, probing of the pockets, and testing the mobility of teeth are good insurance against errors that might readily result from a diagnosis based solely on roentgenographic evidence.

Alveolar resorption patterns in degenerative changes may occur in endless variations —on one surface of a single tooth, on all surfaces of only one or a few teeth, or equally active throughout an entire dentition. The four illustrations in Fig. 16 are from roentgenograms of the right and left mandibular molar areas of the same patient; the changes shown occurred in a period of three years. This illustration is typical of alveolar resorption in Periodontosis and of its unpredictable progress. In the illustration on the lower right the mesial root of the first molar has an apparently intact alveolar support but the distal root is almost denuded. In the illustration on the

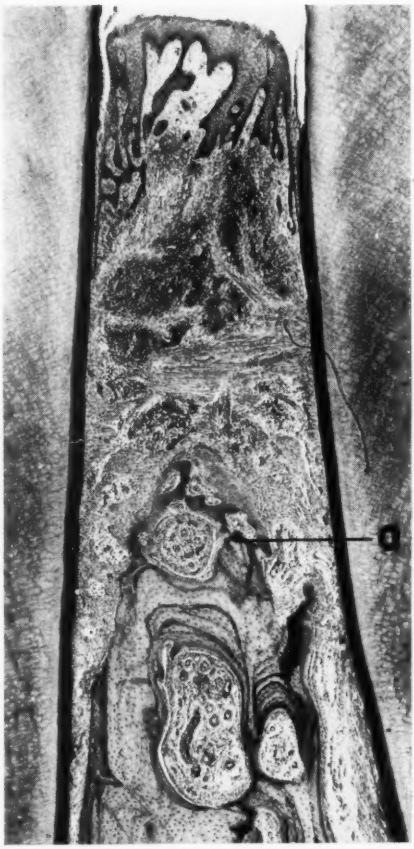


Fig. 14. Photomicrogram of an interdental space showing a severe inflammatory condition in the gingiva and active bone formation at the alveolar crest. A roentgenogram would show no bone above the well-calcified crest at (a).

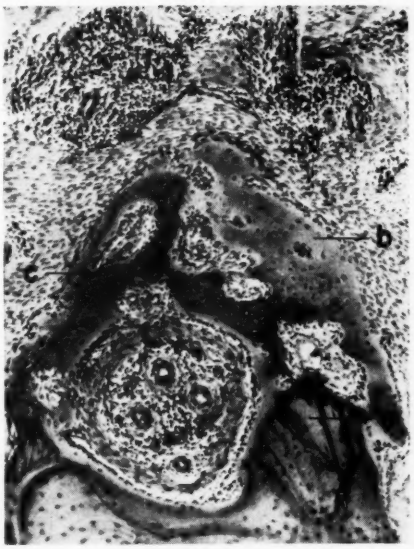


Fig. 15. Higher magnification of the alveolar crest shown in Fig. 14. (a) Mature well-calcified bone. (b) Uncalcified (osteoid) and (c) immature new bone at crest—incapable of casting a roentgenographic shadow.

lower left the distal surface of the mesial root of the first molar and the distal surface of the second bicuspid have not shared the fate of adjacent root surfaces.

OCCLUSAL DISHARMONIES

The role of disharmonies in occlusion as a factor in the periodontal diseases has been the subject of many papers.

Continuing with the plan of correlating clinical, histologic, and roentgenographic evidence, a diagrammatic illustration of our concept of the roentgen evidence of occlusal trauma is shown in Fig. 17. With a full complement of teeth and good mesial and distal contacts it is inconceivable to us that there could be appreciable tooth movement in any but a buccal and/or lingual direction. If a tooth is subjected to movement of this type, there will be a widening of the periodontal membrane surrounding the apex and on the buccal and lingual surfaces near the crest, as shown in A. The only roentgenographic evidence available to the clinician would be the increased periodontal width at the apex (B). To show roentgen evidence of changes on the buccal and lingual margins it would be necessary to obtain a roentgenogram of a single tooth with the angle of projection in an antero-posterior direction.

If buccal and lingual tooth movement persists over a long enough period of time, the entire periodontal membrane may become widened and the roentgen shadow, in the usual projection, would be as shown on the right in Fig. 17 (C).

Examples of these changes are shown in Figures 18, 19, and 20. In Fig. 18 the maxillary bicuspid exhibits an extremely wide periodontal membrane. The bicuspid in the lower illustration shows a typical periapical radiolucence due to a prolonged buccal and lingual tooth movement. The mesial root of the first molar presents an obviously increased periodontal width for the full length of the root. These teeth were very loose but there were no pockets and almost no loss of alveolar crest. The molar in the upper picture of Fig. 19 and the third molar in the lower picture of the same figure illustrate the periapical appearance that we believe to be early evidence of occlusal trauma. These teeth were slightly mobile but without roentgenographic evidence of bone resorption at the alveolar crests. The lateral incisor in Fig. 20 had been subjected to severe trauma for years, and, although the tooth was very loose, there was no periodontal pocket.

DISCUSSION

The maximum height of any interdental septum would be of a straight line connecting the cemento-enamel junctions. A flat crest in the presence of strongly convex teeth is a normal finding and not to be interpreted as evidence of arrested resorption unless it is found below the expected level. The only anatomic arrangement that permits a sharply pointed crest is a combination of relatively flat tooth surfaces and

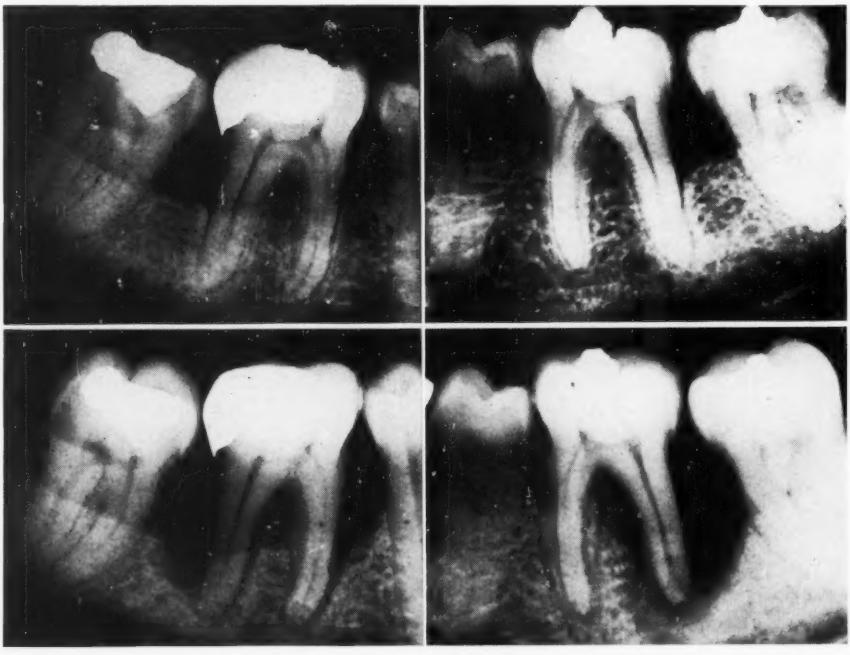


Fig. 16. Periodontosis. Roentgenograms above were taken three years prior to those below. These roentgenograms demonstrate a typical pattern of progressive bone resorption from degenerative processes.

cemento-enamel junctions that are strongly convex toward the occlusal or the incisal surfaces. Crests of this type are frequently observed in the mandibular incisor region but rarely occur in bicuspid or molar areas.

Almost any set of intra-oral roentgenograms will exhibit differences in crown length or in the state of eruption and every interpretation of alveolar crest profile should be based on the influence of these factors.

If we accept the concept that teeth tend to assume a position in the jaw which places their longitudinal axes parallel with the direction of the resultant of the masticatory forces,[4] it becomes obvious that we should see many cases in which the teeth deviate from a vertical position. The interpretation of roentgenograms presenting

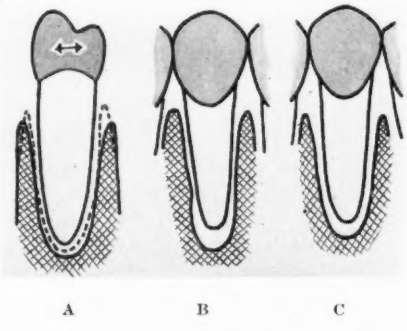


Fig. 17. Diagrammatic illustration of author's concept of the results of occlusal trauma. Left: Initially a buccal and lingual tooth movement produces widening of the periodontal membrane and resorption of alveolar bone at the apex and at the crest on buccal and lingual sides. Center: The only roentgenographic evidence of these changes would be seen at the apex as a widening of the periodontal space. Right: Prolonged tooth movement produces widening of the entire periodontal membrane.

oblique crests in the presence of mesially inclined teeth should be based on a recognition of the fact that in such cases crest profiles must be oblique to conform to the relation of the cemento-enamel junctions.

Before a loss of bone is interpreted to have occurred from inflammatory or degenerative changes it is important that the diagnostician bear in mind the anatomic limitations of each crest and that the pathologic process be envisioned as having started from that point.

The fact that we have chosen to emphasize the need for a rigid discipline in the interpretation of roentgenograms of the alveolar crest area should in no way be considered as an intent to disparage the prevalence of occlusal disharmonies or to cast any reflection on procedures aimed at

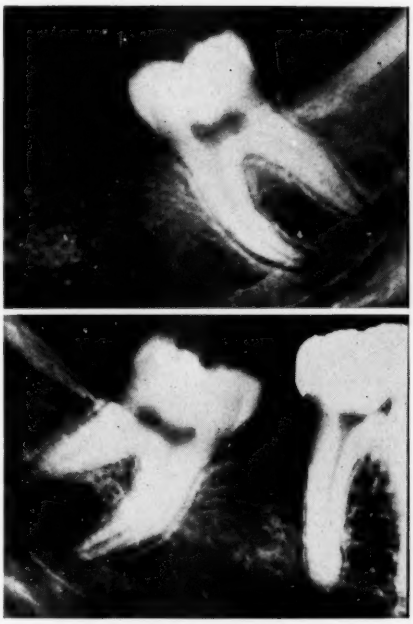


Fig. 19. Widening of apical periodontal membrane as a result of occlusal trauma. No resorption of alveolar crest.

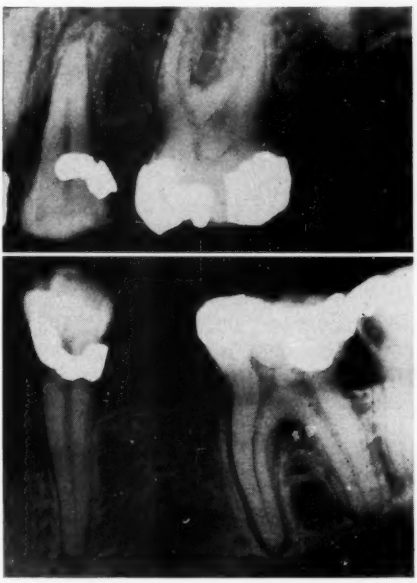


Fig. 18. Roentgenograms of heavily traumatized teeth, maxillary as well as mandibular. The bicuspids exhibit extreme mobility but are without pocket formation or material loss of alveolar bone. Rarefaction at apex of bicuspids and the increased periodontal membrane on mesial root and in the bifurcation of the first molar.

their detection or correction. It has been our experience that these disharmonies occur frequently and it is our belief that their correction is a contribution toward a more nearly ideal functional relation; but, it has not been our experience that roentgen findings can be correlated with occlusal disharmonies. Specifically, we have reference to a recent publication[5] in which it was stated, "that solely by roentgenographic evidence it is often possible to make a diagnosis of the existence and character of an occlusal disharmony."

The most frequently observed disharmony in occlusion is probably that in which the mandible must be moved anteriorly from the point of initial tooth contact in order to produce a maximum intercuspation. This disharmony is commonly referred to as a functional mesial displacement of the mandible. (See diagram in Fig.

Fig. 20. Roentgenographic evidence of severe and prolonged trauma—root resorption and widening of the periodontal membrane. No pocket formation.

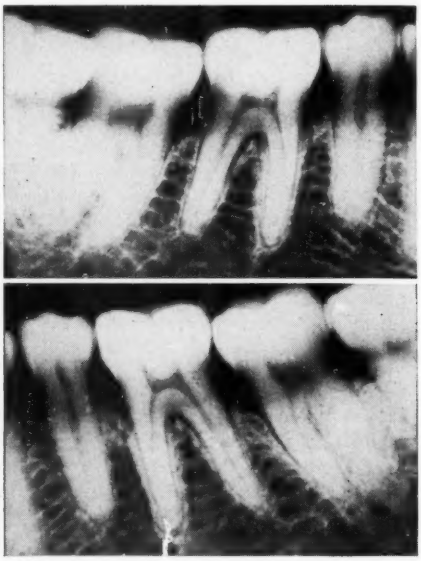


Fig. 22. Roentgenograms of a twenty-eight year old female. The alveolar crests conform to the positions of the cemento-enamel junctions of the mesially inclined teeth. There was no occlusal disharmony and no periodontal disease.

21.) In a disharmony of this type the mandibular teeth receive a thrust directed mesially and the maxillary teeth a pressure towards the distal. It has been claimed that this condition, through the pressure exerted, produces a definite pattern of bone resorption in which there is a greater loss of bone on the mesial surfaces of the mandibular teeth than is evidenced on the distal surfaces of neighboring teeth.

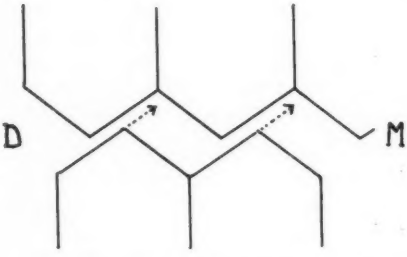


Fig. 21. Diagrammatic illustration of an occlusal disharmony in which the mandible must be moved anteriorly from the point of initial contact to permit maximum intercuspation.

If such were the case, that is if resorption occurs on the side of pressure, we should expect to see a similar response in the maxilla with the greater loss of bone being evidenced on the distal surfaces. It has been impossible for us to find even one instance where the roentgen evidence conformed to this hypothesis.

The illustration in Fig. 22 exhibits the oblique mandibular crests which we believe to be typical of those that are claimed to point toward a diagnosis of an occlusal disharmony characterized by a mesial displacement. This patient is a young adult without periodontal disease, without premature contacts, and with a good maxillo-

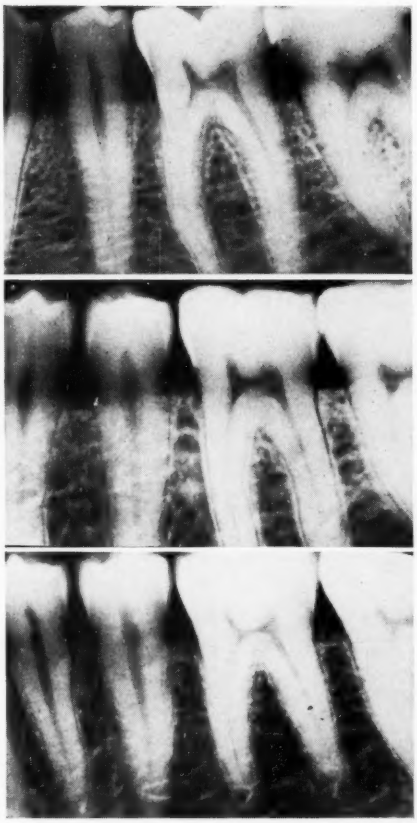


Fig. 23. Roentgenograms of mandibular bicuspid and molar areas of three patients (upper: age twenty, center: age thirty, lower: age forty-six) each of whom had a demonstrable occlusal disharmony of the type illustrated in Fig. 21. There are no alveolar changes observable roentgenographically. The crests conform to the dictates of the cemento-enamel junctions.

mandibular relation. In our opinion the mandibular crests are oblique because of the position of the cemento-enamel junctions.

The illustrations in Fig. 23 are from roentgenograms of three patients each of whom has a disharmony between maximum intercuspation (occlusal position) and the most retruded position of the mandible. Patients' ages are twenty (top), thirty (middle), and forty-six (below). The contours of the alveolar crests are what we expect to see in cases where teeth are of even crown size, without exaggerated crown contour, and placed in a nearly vertical position in the jaw. The occlusal disharmonies have not affected the alveolar crests and our prediction is that they will not.

The roentgenogram illustrated in Fig. 24 is from a patient with mesially inclined teeth, and show a severe periodontitis; and occlusal disharmony necessitated a mesial displacement of the mandible to permit maximum intercuspation. The profile of the mandibular alveolar crests conforms to the hypothesis of bone loss on the side of pressure, but the profile in the maxilla would have to be reversed to be in keeping with the theory. There is no mystery involved in such cases if one accepts the fact that in the absence of periodontal disease the cemento-enamel junctions are the deciding factor in

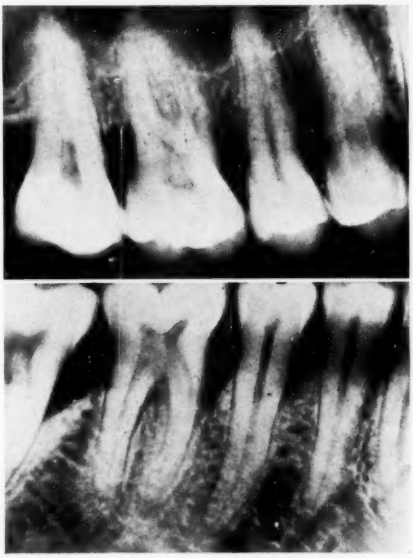


Fig. 24. Periodontitis. The mandibular teeth are mesially inclined and the alveolar crests conform to the position of the cemento-enamel junctions. The maxillary teeth, nearly vertically positioned, show alveolar crests also conforming to the position of the cemento-enamel junctions.

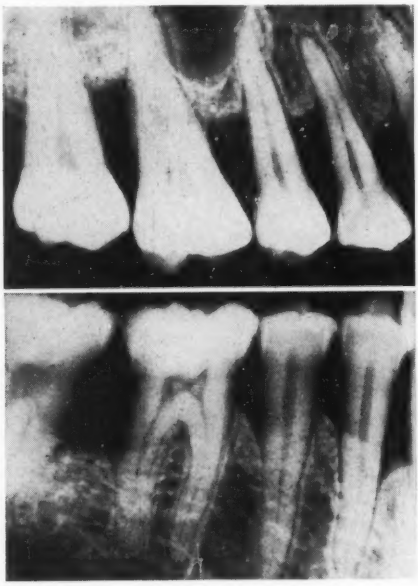


Fig. 25. Periodontosis. Alveolar crests no longer conform to cemento-enamel junctions. The resorption pattern is opposite to that claimed to accompany the mesial displacement.

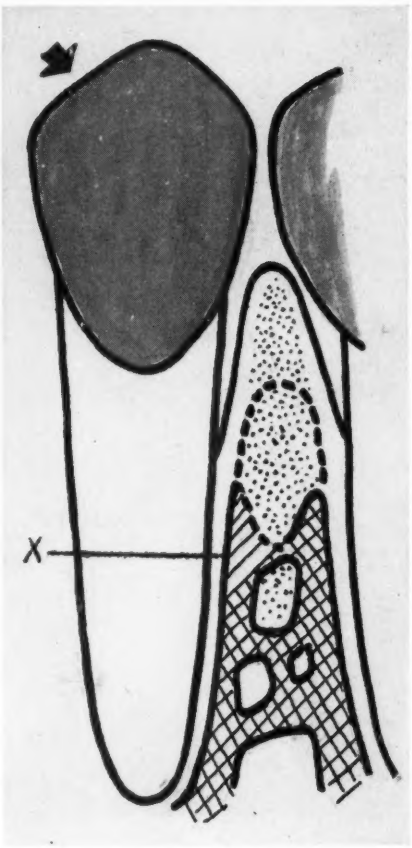


Fig. 26. Diagram of a theoretically possible loss of bone on the side of pressure if combined with a severe periodontitis and a lack of proximal contact.

the profile of the alveolar crests. The presence of severe inflammatory condition has only accentuated the oblique direction of the crests.

Fig. 25 is an illustration of a roentgenogram from another patient in which there was a pronounced mesial displacement of the mandible. The pattern of resorption of the mandibular alveolar crests is exactly opposite to that called for by the hypothesis of bone loss on the side of pressure. In this case there is no longer any correlation of cemento-enamel junctions and crest configuration. To the best of our judgment there is only one explanation for such findings: the loss of bone is due to a degenerative process.

If occlusal trauma can alter the pattern of alveolar bone resorption except as illustrated in the diagrams in Fig. 17, it is our feeling that it could do so only in the presence of a severe chronic periodontitis and in the absence of proximal tooth contact on the side toward which the trauma was directed. The diagram in Fig. 26 illustrates the roentgenographic profile that possibly could result under the conditions just mentioned; that is, the margin of the crest on the side of pressure might show an alteration of a typical inflammatory resorption. Loss of bone on the side of pressure (X in Fig. 26) would change the contour from the typical scalloped crest of inflammatory resorption to an oblique

crest. It seems more probable to us that under these conditions such a tooth would assume a position more in harmony with its environment by moving in the direction of the force until the pressure had been relieved or until contact had been established with an adjoining tooth.

CONCLUSIONS

1. In the absence of periodontal disease the configurations of the crests of the interdental alveolar septa are determined by the relative positions of the cemento-enamel junctions.

2. In the presence of periodontal disease alterations in the configuration of the interdental alveolar septa are governed principally by the specific pathologic process.

3. Assuming mesial and distal contacts between the teeth, no correlation is believed to exist between occlusal disharmonies and the roentgenographic appearance of the crests of the interdental alveolar septa.

SUMMARY

Roentgenographic and histologic material was presented to illustrate the influence exerted on the configuration of the interdental alveolar septa by variations in the shape, state of eruption, and position of the teeth; by some of the periodontal diseases; and, by disharmonies in occlusion.

Emphasis was placed upon the necessity of a critical evaluation of roentgenograms presented as evidence of the existence or the character of occlusal disharmonies.

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DR. CELIA RICH

The many friends of Dr. Celia Rich of Nashville, Tennessee will regret to learn that she died on Sunday April 12, 1953. Details will be published later.

A Rational Plan for Periodontal Therapy*

by SIGURD RAMFJORD, L.D.S., PH.D., *Ann Arbor, Michigan*

INTRODUCTION

STATISTICAL evidence indicates that an increasing percentage of the teeth which are extracted are lost due to periodontal disease.[1,2] With a steadily larger group of the population attaining old age, which seemingly predisposes to loss of teeth due to periodontal disease, and the expected substantial decrease of dental caries due to fluoridation of the water supply, there is reason to believe that periodontal therapy in the future will occupy an increasing percentage of the dentist's chair-time.

A discouraging feature of this prospect is a prevailing confusion concerning periodontal management, found among a large percentage of the dental profession. The common explanation is the old complaint that we don't know enough about periodontal disease to institute an efficient rational therapy. Neither did C. V. Black know everything about dental caries and filling materials, but his system for therapeutic procedures in operative dentistry has been of invaluable service in the fight against loss of teeth from dental caries. It should be understood that prevention or rational therapy following complete knowledge of the pathogenesis is the ultimate goal in the struggle against all disease, but many diseases can be controlled and to a large extent prevented without such complete understanding of the entire disease process.

Present knowledge on the pathogenesis of periodontal disease is not by any means complete, but if the data were properly utilized which are available in today's periodontology, it would be possible to substitute the popular "trial therapy" with a rational therapy[3] for the great majority of patients with periodontal disease. Furthermore, if a well planned routine periodontal procedure was generally accepted and skillfully performed, chances are that the results would be fairly good even if the practitioner did not have the entire accumulated periodontal knowledge available. Few, if any, think of all the valid reasons for Black's cavity preparation every time they utilize his principles, and it is felt that a similar routine procedure for periodontal therapy would save many practitioners from overlooking and "forgetting" important features of periodontal management.

THE ROLE OF DIAGNOSIS IN TREATMENT PLANNING

The periodontal lesion to be treated is always, or nearly always, an inflammatory lesion, caused, as in the case of other localized inflammatory lesions, by local irritation or injury extensive enough to overcome the local and systemic tissue resistance and create disease.

The rational approach in treatment of localized inflammation is to eliminate the injurious agents, and if necessary or possible, to stimulate the systemic and local recuperative power of the patient. But, as in the case of several other inflammatory lesions, one may for various reasons not be able to eliminate the irritants. It may be an organism against which no eliminating agent is known, or it may be an environmental hazard which is unavoidable. In the mouth one finds a multiplicity of factors normally present which singly or combined, under unfavorable circumstances may act as irritants. One of the most confusing facts in the diagnosis of periodontal disease is the wide individual variation in response to injury of the periodontium. A minor irritant which may be easily overlooked in persons with low resistance,

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initiate and maintain a pathologic periodontal reaction, while another person may go around with an "umbrella" gold crown for twenty years without appreciable damage to the supporting tissues. This situation is by no means unique for the periodontium. The gastric mucosa for example, will also show a marked difference in reaction to stimuli or irritants from one individual to another, and a lesser degree of difference from time to time, in the same individual. In cases of abnormal periodontal response to injury or "diathesis" of the periodontal tissues, the response to local irritaton may be far out of proporton to normal response, but still local irritation is the direct cause of the inflammatory periodontal disease.

It is the aim of the diagnostician to detect the local irritants and to evaluate the patients' response to injury. Later, during the treatment planning it has to be decided if those irritants can be eliminated and if the patient response to injury can be improved. The examiners' ability to detect local irritants is proportionate to his knowledge of those irritants and their mode of action. A trained observer who knows what to look for, and who follows a comprehensive examination routine is much more apt to discover the causative factors than a casual observer. A few dentists also limit their chances to discovering the causative irritants by categorically declaring that they don't believe in traumatic occlusion, or some other irritating factors.

The evaluation and diagnosis of the patient's constitutional and local response to periodontal injury and of his recuperative power are difficult. The most reliable guide is the information which can be obtained by a thorough clinical and roentgenographic study of the relation between function, injury and response in each patient's periodontium. This so called "bite analysis"[4] is of utmost importance in all periodontal diagnosis and should be utilized as a routine procedure in other branches of dentistry.

Histologic examination of the gingival tissues, so far, seems to be of limited practical value in the diagnosis of periodontal disease, because of the histologically nonspecific responses to injury which is characteristic of periodontal disease.

A detailed discussion of periodontal diagnostic procedures is not within the scope of this paper, but the fundamental principles for diagnosis had to be outlined because proper diagnosis is the basis for the rational periodontal therapy.

TREATMENT PLANNING

The goal of the therapeutic procedures in periodontia is to eliminate injurious agents and provide optimal individual resistance against potential injury, in other words: To establish and maintain a physiologic state of health in the entire periodontium.

The fundamental principles for periodontal therapy are few and simple and they apply to every case of periodontal disease. A practical way to make a treatment plan is therefore, following a comprehensive diagnosis, to check each individual case against the requirements which have to be satisfied in order to obtain periodontal health, and furthermore, to see if it is possible by available technics to fulfill these requirements.

For rational and practical reasons the management of periodontal disease has been divided into four phases:

1. Systemic phase
2. Hygienic phase
3. Corrective phase
4. Maintenance phase

The systemic phase can be divided into:

A. Consideration of constitutional status, with emphasis on nutrition, metabolism, and hormonal balance.

B. Recognition of systemic diseases which may modify the therapeutic procedures. (Rheumatic or congenital cardiac insufficiency, blood dyscrasias, diseases in contagious stage).

(Modification of an outline by Robinson and Kerr).

A. It is plausible that everything which can be done to improve the general state of health, mainly in relation to nutrition, metabolism and hormonal balance, will contribute to a good result of the periodontal therapy. But very seldom, if ever, will systemic treatment have any direct beneficial effect on the periodontal tissues in the common types of periodontal disease. Even in the rarely seen cases of grave nutritional and hormonal imbalance with periodontal, as well as other manifestations, will systemic therapy alone not be satisfactory. No direct relationship has ever been established between specific systemic diseases and the common types of periodontal disease, and clinical experience has proven that periodontal disease can be satisfactorily treated in the presence of a wide variety of systemic diseases. It is well known that localized infection and inflammation elsewhere in the body can be successfully managed in the presence of systemic disorders, and periodontal inflammation does not constitute any exception from the general biologic laws.

The main systemic factor which is related to periodontal response is the constitution, and little or nothing can be done to change this factor except in grave cases of nutritional or hormonal disturbances. In the overwhelming majority of patients with periodontal disease there is no rationale or indication for systemic therapy. If the medical history did not reveal any suspicious conditions which, for the sake of the general health of the patient, should be further examined, there is no rationale for sending a patient through physical examinations and a large series of laboratory tests because of his periodontal disease. The periodontal response can so far only be evaluated from local observation and roentgenographic examination. No laboratory test is as yet available for such an evaluation.

B. The other aspect of systemic disease in periodontia is the influence these diseases may have on the practical therapeutic procedures. Diseases such as rheumatic or congenital cardiac insufficiency and several of the blood dyscrasias will necessitate special therapeutic precautions which may complicate or even make satisfactory treatment impractical, but the local periodontal procedure will essentially be the same as in a healthy individual.

2. The Hygienic Phase of Periodontal Therapy may be divided into:

   A. Dental prophylaxis
      a. Scaling, removal of overhangs, temporary fillings, temporary splints.
      b. Filing and polishing of rough surfaces.

   B. Teach the patient value and methods of attaining proper oral hygiene.

   C. Observe patient's cooperation and tissue response.

The manifestations of periodontal disease are confined to the soft tissues surrounding the teeth but one should not forget the direct relationship between the teeth and periodontal disease, if the teeth are eliminated, the periodontal disease is also eliminated. The only way to treat this disease successfully is therefore to remove the irritants which are associated with the teeth either as surface or as dysfunctional irritants. The hygienic phase of the treatment is concerned with the surface irritants. Local irritation from dental plaques, materia alba, and calculus is the most common cause of periodontal disease, and all accretions on the teeth have to be removed and new accumulations prevented in order to establish and maintain periodontal health. Complete removal of subgingival calculus often is very difficult and only when the technical skill in this procedure is brought up on the level with the dentist's proficiency in other branches of dentistry, can we expect equally good results in periodontia and in restorative dentistry. It is of course equally important to remove overhang of fillings and other surface irritants. Not only should gross calculus and overhangs be re-

moved, but it also is important to file and polish the denuded tooth surface both for the sake of elimination of mechanical irritation and even more in order to facilitate future cleanliness.

To teach the patient who is living on "civilized food" an adequate home care is an essential part of the periodontal therapy, and the dentist's ability as an educator in oral hygiene is as important as his technical proficiency. Mechanical cleansing of the exposed tooth surfaces repeated regularly at intervals not exceeding twelve to fifteen hours is so far the only known way to restrict or eliminate calculus formation. Methods and technical means to achieve good oral hygiene have to be adapted to each patient's gingival tissues and his dexterity to perform the advised procedures. Establishment of a good oral hygiene should be accomplished over a relatively short period of time. The patient should be treated and given repeated instructions in home care two or three times a week until he is able to keep the accessible surfaces of his teeth clean. Shrinkage of gingiva, improved circulation, and increased amount of protective keratohyaline on the gingival surface, produced by the hygienic phase, will facilitate the future maintenance of clean teeth and increase the resistance to potential local irritants always present in the mouth.

This is also the time for final evaluation of the treatment plan according to the observed tissue response and patient cooperation. It should be considered at this time that poor results in teaching the patient home care is not always due to a "poor student." For a large number of patients with incipient periodontal disease, the hygienic phase is all the periodontal treatment needed. However, it is unfortunate that a surprisingly large percentage of dentists consider the hygienic phase of treatment synonymous with periodontal therapy and therefore can treat successfully only the cases of incipient periodontal disease which are the result of poor oral hygiene.

3. The Corrective Phase of Periodontal Therapy may be divided into:

   A. Adjustment of occlusal disharmony.

   B. Operative and restorative procedures with special reference to periodonto-prosthetics (splinting of teeth when the periodontal support is inadequate for normal masticatory function).

   C. Elimination of residual periodontal pockets.

As an aid in periodontal therapy, occlusal adjustment is indicated in order to:

a. Eliminate dysfunctional irritation (traumatic occlusion) in supporting structures.
b. Improve masticatory relations between the teeth.
c. Induce physiological wear of occlusal surfaces.
d. Reshape and recontour teeth for protection of gingiva.
e. Eliminate bruxism.
f. Relieve traumatic temporomandibular joint arthritis (which is not directly a periodontal problem).

It is not possible within the scope of this paper to evaluate the rationale for occlusal adjustment, and its importance as an adjunct in periodontal therapy, but it should be emphasized that occlusal adjustment is not a panacea for the treatment of dysfunctional periodontal irritation. Orthodontics and reconstructive dentistry may have to be utilized. Orthodontics prior to occlusal adjustment and restorative dentistry following occlusal adjustment. However, the periodontal disease may have reached such an advanced stage that the requirements for normal function will act as an irritant on the remaining supporting structures regardless of an even distribution of masticatory stress.

The periodontium is a functional organ as well as the kidneys or liver, and a certain amount (individually different) of functional tissue is required in order to maintain a physiologic state.

Dental restorations should:

a. Protect gingiva from surface injury by functional morphology.
b. Provide masticatory efficiency combined with physiologic distribution of stresses.
c. When splinting is indicated, preferably utilize fixed attachments and rigid constructions.

Uneven wear and positional changes of the teeth may, from periodontal point of view, call for restorations which do not in any way conform to normal anatomical morphology of the teeth. A thorough functional analysis during the diagnostic procedures will supply the necessary information indicating where and why restorations are needed. The type of restoration should be determined by the previously given principles of gingival protection and optimal function.

Residual periodontal pockets should be eliminated by:

a. Subgingival curettage.
b. Gingivectomy.

A large percentage of gingival and periodontal pockets will be eliminated by shrinkage during the initial hygienic phase of the periodontal treatment, but in some cases in which the pockets were deep and chronic proliferative inflammation had led to fibrosis of the free gingiva, or in the cases of intra-alveolar pockets, one will face the problem of residual pockets which have to be eliminated in order to maintain a good oral hygiene. The choice of procedure for pocket removal should be based on a rational approach.

The ideal way to eliminate a periodontal pocket is by reattachment following subgingival curettage, but only in a relatively limited percentage of cases can a situation be established which is conducive to reattachment. All the irritants which were responsible for the pocket formation have to be eliminated and the gingival tissues brought in a good state of health before connective tissue reattachment can be expected.[6] The pockets must be accessible for an efficient epithelial and cemental curettage, and conditions must be optimal for a rapid organization of the blood clot in the pocket following the curettage. The indications for subgingival curettage are therefore restricted to narrow deep periodontal pockets especially of the intra-alveolar type and preferably in the anterior part of the mouth. A firm, thick free gingival wall closely adapted to the tooth surface will also facilitate healing.

If the periodontal pocket does not conform to those requirements it should be eliminated by surgical means. But, as discussed in a previous article,[7] an optimal pre-operative state of health in the gingival tissues will also here provide the best results. Gingivectomy is indicated when gingival and periodontal pockets deeper than 2-3 mm. can not be eliminated by subgingival curettage. The rational for gingivectomy is to enable the patient to keep the exposed surfaces of his teeth clean, and if that (as in the case of an exposed trifurcation of an upper molar) can not be accomplished, the operation is not indicated.

A surgical contouring of the gingiva, gingivoplasty may also be indicated at this stage of the treatment in order to avoid surface injury during mastication.

4. At the completion of the corrective phase of the treatment, the periodontal tissues should be in a physiologic state of health which can be maintained by a reasonable amount of future care.

One often hears the statement that periodontal therapy is discouraging because the patient can never be considered as cured. Neither is the patient cured for caries because his cavities are filled. Actually, there are only relatively few diseases which leave the patient in a state of permanent immunity. The patient is cured of periodontal disease as long as the causative factors can be kept under control, but with future irritation he will also experience recurrence of the disease. How often the patient should be called in to the dental office for control

depends on how well he can keep up his oral hygiene. It is often wise to teach the patient the use of a disclosing solution so he can control the efficiency of his own oral hygiene. No definite time interval can be set between each visit to the dental office for maintenance of periodontal health, but the patient should be examined at least two to three times a year for check of oral hygiene and eventual new caries, adjustment of dental appliances, etc. He should also have bitewing x-rays taken once a year for the same reasons.

THE PRACTICAL APPLICATION OF THE OUTLINED PROCEDURES

For each patient with periodontal disease a treatment plan should be made out following the sequence of order which has been listed for periodontal therapy. Starting with: Phase one, it should always be decided if the patient needs systemic therapy, or if he has any systemic disease which will modify or complicate the practical management of his local periodontal disease.

Phase two, every patient with periodontal disease has to go through phase two and a satisfactory result of periodontal therapy can not be obtained without the establishment of a good oral hygiene. For many patients the hygienic phase will cure their periodontal disease and they can be transferred to phase four for maintenance, skipping phase three.

Phase three, all the patients whose periodontal disease is not incipient and solely a problem of oral hygiene, will have to be considered for phase three, and from the standpoint of treatment planning, the complicated problems often start here. As stated previously, one will sometimes find traumatic occlusion which, because of extreme malposition or advanced loss of supporting structures, can not be converted to a physiologic occlusion. Before condemning the involved tooth or teeth, the possibility of utilizing splinting procedures should be considered. The amount of residual functional periodontal tissues is often the decisive factor in determining whether it is possible to save the teeth or not, and it is closely connected to the restorative phase of the therapy. The elimination of residual pockets may also constitute practical problems. Poor esthetics in the anterior region of the mouth might make it undesirable to save the teeth even if it could be done by periodontal therapy. Pockets deeper than 2-3 mm. can not be kept clean, therefore they have to be eliminated or the periodontal disease will proceed, so if the pockets can not be eliminated by subgingival curettage or by gingivectomy, the only way to stop the disease is to extract the involved tooth or teeth.

A rational treatment for periodontal disease is a treatment which will reinstitute periodontal health, and unfortunately a large number of patients seek advice at such an advanced stage of their disease that this goal can not be reached. Even if calculus initiated and for years has been the major cause of the disease, and the calculus could be removed, that does not necessarily mean that the patient can be successfully treated, because all the other requirements which have been listed (adequate support, restorations, pocket elimination, etc.) will also have to be considered in order to reinstitute periodontal health.

Advanced cases of periodontal disease with the teeth still in a fairly good functional and esthetic state, but with the amount of supporting tissue loss too extensive for a rational treatment, are often retained temporarily by palliative therapy. Three serious considerations have to be settled before such palliative therapy is instituted.

First, the danger of the persisting periodontal lesions as foci of infection. Secondly, the progressive loss of future support for prosthetic appliances, the significance of which depends on the approximate number of years one may assume the patient will have to use a prosthetic appliance. Thirdly, the patient is apt to experience

discomfort from his lesions even if palliative treatment is given, and he is furthermore apt to blame the therapist for the discomfort.

SUMMARY

The value of treatment planning in relation to a rational outline for periodontal management has been discussed, and a basic outline for therapeutic procedures has been suggested.

The significance of the teeth, their surfaces and their functional relations, in the pathogenesis of periodontal disease makes periodontia a major problem of general dentistry, because many of the causative factors in periodontal disease can be eliminated only by a complete dental service.

The hazards of a palliative periodontal therapy have been stressed.

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A Calibrated Silver Point for Periodontal Diagnosis and Recording*

by LEONARD HIRSCHFELD, D.D.S.,** *New York, N. Y.*

IN the diagnosis and charting of periodontal disease, a probe with millimeter markings is an indispensable instrument. With it one can measure the distance from the gingival margin to the epithelial attachment and subsequently observe the changes in the pocket depth as treatment progresses. The relationship of the alveolar bone to the pocket, however, cannot be demonstrated with this type of probe. The instrument also has little value in making radiographic records since it is difficult for it to be held in place during the time of exposure and the millimeter markings cannot be discerned in the radiograph.

Another adjunct in diagnosis is the gutta percha root-canal point, which may be inserted into the pocket before a radiograph is made. The tip of the radio-opaque point indicates the site of the epithelial attachment and the relationship of the bottom of the pocket to the alveolar bone. It is especially valuable in studying proximal infrabony pockets and deep palatal, lingual and labial pockets where the radio-opacity of the root prevents accurate delineation of the bone level. Another purpose for which it is used is to trace the path from a fistulous opening to an abscess. The flexibility of the tip of the gutta percha point permits it to be inserted into some spiral or irregular pockets, but the great flexibility may cause the tip to bend or curl before it reaches the full depth of the pocket.

An additional instrument, which com-

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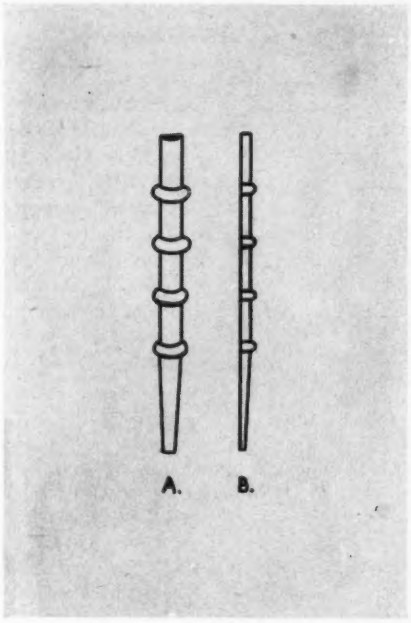

Fig. 1. (a) A twelve-millimeter calibrated silver point showing the outline observed in measuring a labial or lingual pocket. (b) The same half-round point as seen when a mesial or distal pocket is being measured. The ridges are clearly demarcated when the x-rays come from any direction used in taking periapical radiographs. The other eight points in the set are from four to eleven millimeters in length.

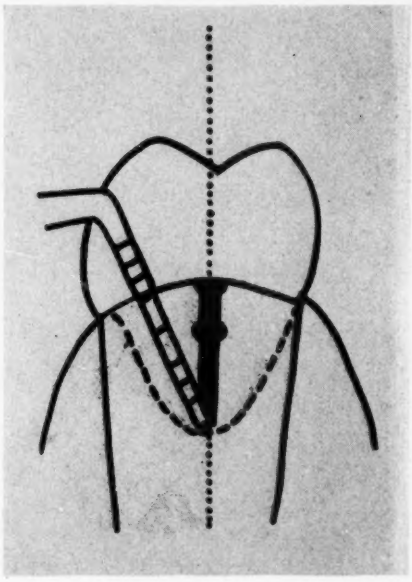

Fig. 2. The silver point can be placed in a proximal pocket parallel to the long axis of the tooth when the adjacent tooth is present, while the conventional probe can be inserted only at an angle.

bines the advantages of the millimeter probe and the gutta percha point, is desirable in order to obtain an accurate picture of the relationship of the entire pocket to the alveolar bone and to the root of the tooth. If these relationships are known, diagnosis, prognosis and the plan for periodontal treatment can be determined more effectively.

For this purpose, a set of calibrated silver points has been devised. These points (Fig. 1) are slender soft silver half-round wires, from four to twelve millimeters in length, with ridges every two millimeters. In order to enable the point to reach the bottom of the pocket, the tip is tapered and the first ridge is omitted. Therefore, there are ridges at four, six, eight and ten millimeters which are readily visible in radiographs taken at any angle used in making intraoral radiographs.

A set of nine points is used, each one of a different length. One is cut off at the four-millimeter ridge, one at five millimeters, one at the six-millimeter ridge, and so forth up to twelve millimeters.

It must be emphasized that the calibrated point is not a substitute for the millimeter probe, but merely a valuble adjunct to it.

TECHNIQUE FOR THE USE OF CALIBRATED POINTS

The depth of the pocket to be studied is first ascertained with a Williams or Merritt millimeter probe. A calibrated silver point of a length equivalent to the pocket depth is grasped with cotton pliers and in-

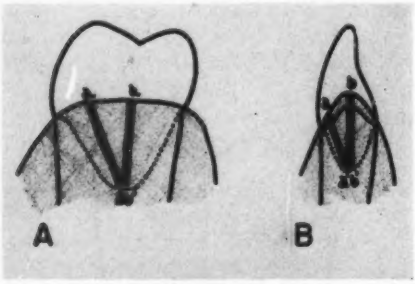

Fig. 3. In deciding the length of the point to be placed interproximally when two posterior teeth are in contact (3a) one millimeter may be subtracted from the reading on the millimeter probe (aa') to compensate for the difference in position of the probe and the point (bb').

serted into the pocket at the same position and angle as had been used with the probe. The flat side of the point lies against the root surface. With the aid of the probe, the point may be moved slightly to cause it to lie in the pocket parallel to the long axis of the tooth, with its tip at the epihelial attachment and its occlusal end at the gingival margin. The area with the point is radiographed and subsequently the point is removed easily from the pocket with a curette.

When the point is in the pocket, it cannot be disturbed by the insertion of the

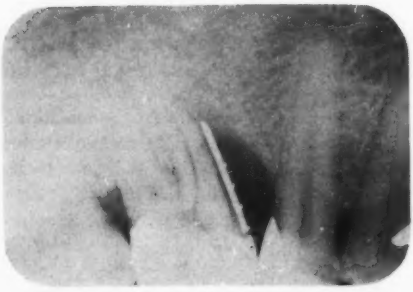

Fig. 4. The radiograph demonstrates the portion of this ten-millimeter pocket that is infrabony—six to seven millimeters. This amount would remain after recession induced by conservative treatment or after the conventional gingivectomy.

film because no portion of the metal is occlusal to the gingival margin.

When an adjacent tooth is in contact, the calibrated point makes a more accurate measurement on the proximal surface than is possible with the probe. When the latter is inserted (Fig. 2) at the angle necessary when an adjacent tooth is present, it is not as parallel to the long axis of the tooth as is the short point, which is pushed under the contact point in order to parallel the long axis. In deciding the length of the point to

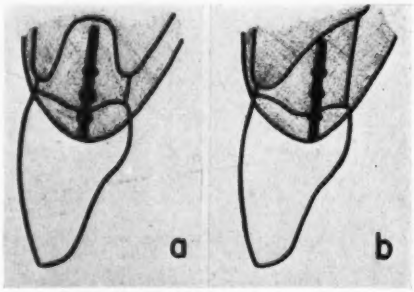

Fig. 5. (a) Diagram of a point in a proximal pocket when the alveolar destruction has formed a crater with labial and lingual spines. It can be expected that this type of pocket will not be eliminated by the conventional types of curettage or gingivectomy, as the soft tissue will fill in at least to the level of the spines. (b) Diagram of a point in a proximal pocket when alveolar destruction on the palatal side is as advanced as that on the proximal. This situation does allow complete elimination of the pocket without osseous resection as the soft tissue may be made to follow the outline of the bone.

be placed interproximally in such cases, one millimeter may be subtracted from the reading on the probe to compensate for the difference in position of the probe and the point (Fig. 3). This precaution is not necessary in the case of the anterior teeth because of the greater curve of the papilla and the narrower labio-lingual diameter of the teeth which permits the probe to be inserted more nearly parallel to the long axis of the tooth.

Although the wire is moderately soft,

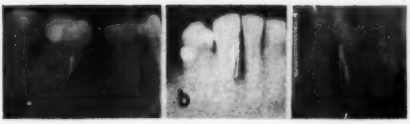

Fig. 6. Radiographs illustrating the use of an accessory point in the lingual part of the pocket to differentiate between the architectures in 5a and 5b. In (a), the point in the mesial pocket indicates the depth of the pocket (nine millimeters) and the number of millimeters that are infrabony (eight). The five millimeter point placed in the lingual part of the pocket shows that the pocket is deep and narrow on the mesial surface but is not too deep on the lingual surface, indicating a better prognosis with the curettage described by Goldman than would be the case if the pocket were deep on the lingual surface too. This could not be demonstrated radiographically without radio-opaque materials in this case. In (b) the same situation is demonstrated in an anterior tooth, while (c) shows a case in which there is practically no palatal destruction at all.

it is not as pliable as a gutta percha point and will not reach the full depth of tortuous spiral pockets. However, it will extend to the bottom of the vast majority of pockets encountered in practice and it can be bent to conform to the contours of most irregularly shaped pockets or roots.

INFORMATION WHICH MAY BE DERIVED FROM THE USE OF CALIBRATED POINTS

The use of the points is not advocated for routine radiographic examination of periodontal patients, but several important facts can be learned from them in selected cases:

1. It is usually possible to observe how many millimeters of a pocket are infrabony (apical to the crest of the bone at that point) and thereby to determine how many millimeters will remain after the soft tissue wall is removed by recession or a gingivectomy (Fig. 4). This enables one to decide whether an osseous resection[1] or curettage for removal of the epithelial attachment and crevicular epithelium[2] is required. It also helps one to determine and record the results after any one of these procedures has been completed.

If there is an interproximal bony crater with high labial and lingual spines (Fig. 5a), which is often the case in anterior areas and even more frequently found between the posterior teeth, the point can demonstrate the amount of pocket that is apical to the labial and lingual spines and which will probably remain after curettage or gingivectomy.

On the other hand, in certain cases, particularly in the anterior areas, there may be little bone loss on the labial side, but extensive destruction on the lingual side, with the septal bone sloping between the two levels as in Fig. 5b. In these cases, the point placed in a proximal pocket will extend further apically than the labial bone and there will be a radiograph similar to the one in the situation depicted in Fig. 5a. However, in 5b there is no lingual spine and recession or gingivectomy can eliminate the pocket completely. To differentiate between the two situations, clinical examination and the use of an additional point on the lingual surface are advisable (Fig. 6). The problem of differentiation is also made less difficult with the application of the long-cone and parallelling techniques.[3,4]

2. A record of pocket depth is made on the radiograph, permitting a more comprehensive visualization of the relationships of the periodontal structures. With the simultaneous use of several points in different parts of the pocket, the shape of the pocket can be roughly outlined.

3. It is possible to record the distance from a fistulous opening to its abscess cavity, as well as the location of the fistula in relation to the tooth (Fig. 7).

4. By holding a millimeter rule or probe against the radiographic silhouette of the wire point, it is possible to tell approximately how much elongation or foreshortening of the root exists in the film, since it is apparent that if the point (which is placed parallel to the long axis of the tooth) is foreshortened, the root against which it lies is foreshortened to the same degree. For example, if the silhouette of an eight-millimeter point on a radiograph measures twelve millimeters long, it and

Fig. 7. The distance from a fistulous opening to its abscess (ten millimeters) and the relation of the fistula to the tooth is demonstrated in this radiograph.

the root it lies against have been elongated by fifty per cent. It is important to know how much distortion is present in order to decide how much of the root still has bony support. Even with the long-cone paralleling technique of radiography, a wide-spread palatal root of an upper molar will be distorted to some extent and this can be determined with the aid of the point. The distortion is, of course, much greater with the use of the bisecting technique of radiography.

In using the short-cone technique, it must be remembered that the rays spread from the target and points placed buccal, proximal and palatal to wide posterior teeth will cast slightly different shadows on the film. For practical purposes, however, the differential can usually be ignored.

PRECAUTIONS TO BE OBSERVED IN THE USE OF THE CALIBRATED POINTS

When instrument as small as these points are used in the mouth it is necessary to take several precautionary measures. In the first place, care must be taken to prevent the point from being swallowed or aspirated during insertion. To forestall this, one must be careful that the patient's head is not far back while a point is being placed in a posterior pocket. In addition, the tips of the college pliers must be serrated and must grasp the point with a minimum of pressure while it is being placed in the pocket to prevent the point from slipping from, or being squeezed from the pliers.

Another obvious precaution is the removal of the point from the pocket as soon as the radiograph has been made, since it may otherwise be forgotten in the pocket. When the point is removed it should be placed immediately in a dappen dish to prevent its being lost before and during its cleansing and sterilization.

SUMMARY

A set of calibrated silver points has been devised, combining advantages of the periodontal millimeter probe and the gutta percha point, for use in periodontal diagnosis and recording.

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The Structure of the Epithelial Attachment Revealed by Phase Contrast Microscopy

by LOUIS J. BAUME, D.M.D., M.S., *San Francisco, California*

THE way the gingival epithelium is fastened to the surface of the tooth still is little understood. There is wide consensus that a so-called secondary cuticle constitutes the cementing substance. This hornified surface layer of the tooth is thought to be either the result of cytomorphic changes[9] or the secretory product of the crevicular epithelium.[11,14,15] A recent study[3] confirmed that the epithelial attachment of erupting teeth first is maintained by the elements of the enamel organ which are in continuity with their last product, the primary cuticle. The consecutive histogenetic changes comprised initially a replacement of the atrophied ameloblasts by proliferating enamel prickle cells and finally a replacement of the latter by oral epithelium. However, evidence of the formation of a hornifying secondary cuticle was not ascertained.

The present study deals with the structural elements which procure the mechanical connection between epithelium and tooth surface. Phase contrast microscopy was employed because this new method permits the observation of the tissue in an undenatured state, that is, without fixation and staining.[22]

The scantiness of the present knowledge concerning the epithelial attachment, particularly to the enamel, has been explained by the difficulty of observing it microscopically.[13,15] After decalcification, the enamel is dissolved, whereby any organic connection necessarily is lost. For this reason the existence of the enamel-epithelial junction has been missed for many years[10] and even is abolished again by some recent authors.[1,21] Its demonstration relies upon two procedures: The ground sectioning of frozen tissue blocks of young erupting teeth[6,12,18] and the observation of the adherent epithelium to young extracted teeth.[2,13,17,19] Varying statements have been made as to the firmness of the epithelial attachment to the enamel. Some authors[12,18] consider it so slight that they would prefer the term "adhere" in place of "attached." It is inferred that "epithelial tissue has very little intercellular substance so that the cells are not held together firmly, as in the case with the connective tissue."[7] Others contend that "cytoplasmatic processes"[9] or "projections form reticulated cytoplasm"[2] effect the organic connection with the tooth surface. It also has been suggested that this mechanism of attachment is similar to the epithelio-connective tissue junction at the basement membrane.[16]

MATERIAL AND METHOD

Gingiva obtained at autopsy of Rhesus monkeys and at biopsy of human beings were studied.

There were available the heads of 20 Rhesus monkeys which represented various stages of the mixed dentition. They had been preserved in 10% neutral formalin solution for varying periods, from two weeks up to two years. In order to study the firmness of the epithelial attachment to the epithelial attachment to the enamel, erupting incisors and molars were selected. The gingiva covering their enamel was circumcised and the adherence checked by the force necessary to remove the gingival tissue. After separation the superficial structures of both parts were studied microscopically. For this purpose the surface of

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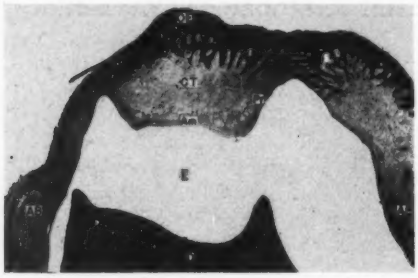

Fig. 1. Transverse section of erupting lower molar of Rhesus monkey shows ameloblasts lining the enamel surface with the exception of the buccal cusp where replacement by prickle cells and fusion with oral epithelium has taken place. Masson trichrome. Orig. Mgf. × 25. Am: Ameloblast, AB: Alveolar bone, CT: Connective tissue, D: Dentin, E: Dissolved Enamel, EE: Enamel epithelium, F: Dentinal fiber, OE: Oral epithelium, Pr: Enamel prickle cell, S: Surface layer.

the denuded enamel was scraped with a sharp scalpel, and the material collected on the blade was inspected under the phase contrast microscope. The removed gingiva was frozen, sectioned, and observed under the phase contrast microscope. For the purpose of comparison some erupting teeth with surrounding tissues were prepared histologically according to the standard method which includes decalcification and staining with hematoxylin-eosin.

The human biopsy material consisted of healthy marginal gingiva of incisors and overlying flaps of erupting molars obtained from six young individuals. The freshly removed specimens were placed in saline, immediately frozen and sectioned at a thickness of 8-10 μ*. The sections suspended in saline without delay were observed and photographed under the phase contrast microscope.

Some of the sections of fresh human, as well as monkey material were submitted to the DOPA-reaction (dioxyphenylalaline) according to Bloch[5] in order to determine whether there was premelanin pigmentation or not.

*Sections beyond this thickness proved to be unfit for phase contrast microscopy because the unfixed cellular structures were destroyed.

RESULTS

1. The Epithelial Attachment to the Coronal Surface of Erupting Molars.

The gingival flaps over erupting molars of monkey specimens preserved in 10% formalin for more than three months could be removed without applying any force if they were circumcised at the level of the tooth neck. In fact, they could be thrown off by swinging the whole specimen upside down. Similar results were obtained with two specimens which after fixation were preserved for 6 months in 80% alcohol. From this the conclusion is drawn that at the time of the removal an organic connection did not exist between the surface of the erupting molar and the covering gingival flap.

The histologic aspect of the gingiva overlying an erupting molar in the monkey is shown in Fig. 1. Ameloblasts still encompass the enamel surface with the exception of that of the most advanced buccal

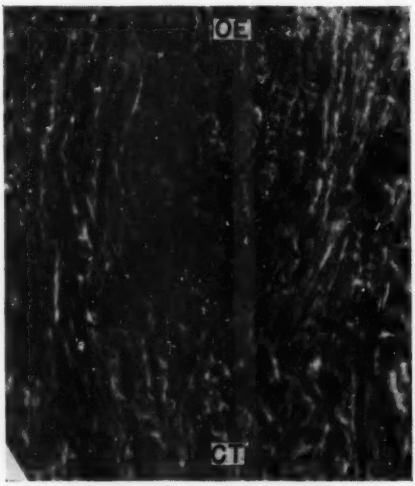

Fig. 2. Rete peg of extensively fixed oral epithelium taken from the gingiva overlying erupting first molar of Rhesus monkey shows little structural details. Formalin fixed, 80% alcohol preserved, unstained. Phase contrast microscope (P.C.M.). Orig. Mgf. × 950.

cusp; here they are replaced by enamel prickle cells which partly have fused with proliferating, intensively staining, oral epithelium.

The phase contrast pictures of similar, unstained tissue that had been extensively fixed reveal only structural details of connective tissue but not of epithelia. Oral epithelium (Fig. 2) shows a dense amorphous cytoplasm while in reduced enamel epithelium some fibrils are dimly visible (Fig. 3).

Fig. 3. Extensively fixed gingival flap covering erupting first molar of Rhesus monkey reveals projection of enamel epithelium with some coarse fibrils. Formalin fixed, 80% alcohol preserved, unstained, P.C.M. Orig. Mgf. × 950.

The blurred aspect of extensively fixed epithelium is contrasted by the structural distinctness of the fresh biopsy specimens. Figure 4 depicts an unfixed and unstained section of gingiva taken from a young Rhesus monkey. Owing to a specific structural arrangement revealed under the phase contrast microscope the oral epithelium can easily be distinguished from the connective tissue. At a high magnification the absence of amorphous cytoplasm and the prominence of the fibrillar components constitute the outstanding features of undenatured oral epithelium of the Rhesus monkeys as well as human beings (Fig. 5). Tonofibrils, always arranged in bundles of approximately 15-25 units are running in every direction to the side of the nucleus from one cell into the other (A). The bundles which cross the plane of the section perpendicularly appear as agglomerations of fine granules (B). The extracellular portions of the tonofibrils are fusiform (C) and represent the intercellular bridges. These fibrils extend throughout the entire width of the living epithelium and disappear only in the superficial keratinous layers (Fig. 4, S).

The behavior of the tonofibrils in the germinative layer which is responsible for their production and elongation, is of particular interest. Careful observation shows that fibrillar continuity is maintained throughout the entire cytoplasm of basal cells which are characterized by large and dense nuclei (Fig. 6). The tonofibrils, though finer in texture, extend in every direction also toward the so-called basement membrane (Fig. 7). This structure is partly translucent and contains a fibrous network which is in continuity with the fine reticulum of the epithelium as well as of the connective tissue (Fig. 8).

The enamel epithelium adjacent to the erupting crown (Fig. 9) exhibits a different pattern due to a specific arrangement of the tonofibrils; they are coarse and sparse as they are not marshalled in bundles. The amount of intercellular bridges is reduced and the cytoplasm has a looser, more granulated appearance than that of oral epithelium. The network of individual tonofibrils, however, is equally continuous through the enamel epithelium.

II. The Epithelial Attachment to the Enamel Surface of Incisors.

The gingival tissue covering the labial surface of erupting incisors of monkey specimens preserved for over three months could readily be removed if two parallel cuts were made from the free margin toward the cemento-enamel junction. The looseness of the connection was best demonstrated by rinsing the flap off with the spray of a water syringe.

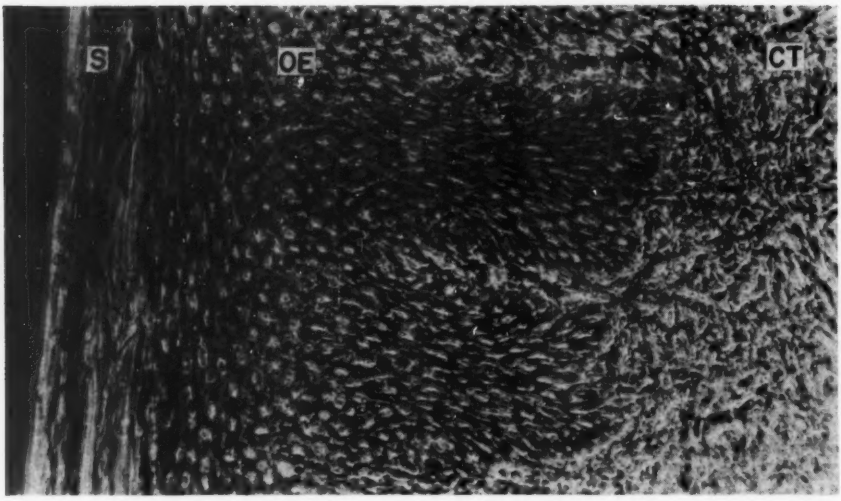

Fig. 4. Oral epithelium of Rhesus monkey as inspected under living conditions exhibits a specific structural arrangement of its cytoplasm. Unfixed, unstained, fresh, frozen section, suspended in saline. P.C.M. Orig. Mgf. × 70.

The histologic aspect of an erupting lower incisor prepared by the regular decalcification method is shown in Fig. 10. The labial surface of the dissolved enamel (Fig. 11) is bordered inferiorly by a narrow layer of ameloblasts (Am) which superiorly is replaced by prickle cells (Pr). Oral epithelium (OE) has proliferated behind the enamel epithelium (EE) only for a very short distance. At the lingual side all ameloblasts have disappeared and for the main part the epithelium adjacent to the enamel surface consists of prickle cells. At two sites of the cervical portion where apparently enamel was not formed, small epithelial connections with the dentin are visible. At a high magnification (Fig. 12) this slightly torn junction shows a distinct fibrous structure. It is noticeable that at the epithelial surface indications of a secondary cuticle are not found. The epithelium consists of four layers of cells which show a lightly stained cytoplasm and distinct intercellular bridges.

In autopsy material preserved for less than a week the gingival covering the crowns of erupting incisors could be removed only by applying some force. A faint film remained on the enamel surface. Figs. 13 and 14 are phase contrast photomicrographs of this film taken from the aspect facing the enamel surface. They reveal the hexagonal pattern of the attached epithelial cells found in transverse histologic sections. The intercellular portions are traversed by some fibrils. The interior shows structures similar to nuclei, often including nucleoli. The proximity of the nuclei to the surface identifies these cells as enamel prickle cells since in the ameloblasts they lie distant from the enamel surface. Around the nucleus a series of dark granules is conspicuous. When the microscopic field is focused up and down these granules are recognized as the tonofibrils which run perpendicularly to the surface of the enamel. They are characterized by their greater thickness and sparser arrangement, in contrast to the compounds seen in oral epithelium.

The removed gingiva exhibits, under the phase contrast microscope (Fig. 15),

Fig. 5. The undenatured oral epithelium displays a prominent fibrillar structure. Tonofibrils arranged in bundles at "A" run continuously from one cell into the other. At "B" a transverse section of a bundle is seen. The intercellular portions of the tonofibrils are fusiform (C). (A schematic drawing is inserted at the right corner). Fresh, unfixed, unstained, human specimen. P.C.M. Orig. Mgf. × 2400.

a histologic aspect similar to that in the fixed and stained section shown in Fig. 11. Oral Epithelium has proliferated as far as "X" behind the reduced enamel epithelium of which the superficial layer has been torn off. The structural difference between both epithelia is conspicuous. The short fixation has effected a precipitation in the oral epithelium which diminishes the transparency of its protoplasm. This shading of fixed oral epithelium is apparent in Fig. 16 especially when it is compared with Fig. 4 which shows a corresponding unfixed section. A negative DOPA-reaction suggests that the shading has nothing to do with melanin pigmentation. High magnifications of oral epithelium (Fig. 17) disclose a slight disintegration of the tonofibrils and an increase in amorphous material in the cell cores. (See also Fig. 2.)

Enamel epithelium behaves differently toward short fixation. Condensation of its cytoplasm is not discernible (Fig. 18). A

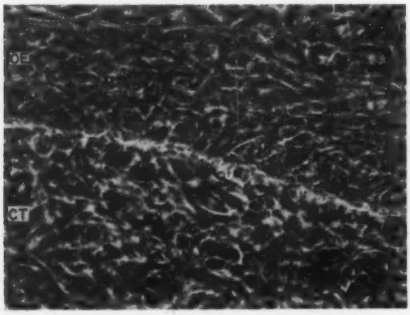

Fig. 6. At the epithelio-connective tissue junction a translucent membrane with fibrillar compounds is discernible. Unfixed, unstained, human biopsy. P.C.M. Orig. Mgf. × 1025.

high magnification shows the structural details such as the tonofibrils completely preserved (Fig. 19).

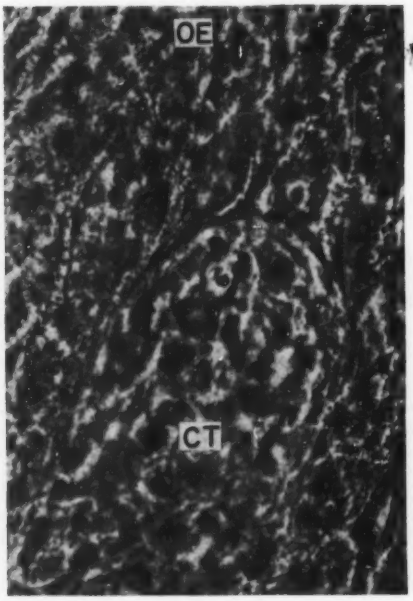

Fig. 7. The continuity of the tonofibrils of the basal epithelial cells with the reticulum of connective tissue is revealed (arrow). Unfixed, unstained, human biopsy. P.C.M. Orig. Mgf. × 1025.

DISCUSSION AND CONCLUSIONS

Though during amelogenesis an organic connection is known to exist between enamel epithelium and enamel matrix, the presence and the fate of this attachment at later stages has been the subject of many theories. The relatively late formation of the primary cuticle, as well as the protracted presence of ameloblasts such as recently disclosed,[3] seems to eliminate the possibility that an early separation prior to the eruption of the crown takes place.

Nevertheless, in the extensively fixed material of this study similar to that of Waerhaug[21] a mechanical connection between crown and covering gingiva was not demonstrable. Our histologic sections showed ameloblasts or enamel prickle cells lining the enamel surface. Furthermore, at no stage of eruption was it possible to detect microscopically a secondary cuticle of the dimensions shown in the texts.[9, 11, 13, 14] Necropsy specimens which are fixed with considerable delay apparently provide this cuticle abundantly. From these observations it becomes evident that the kind and duration of fixation must have a decisive influence upon the firmness, as well as the

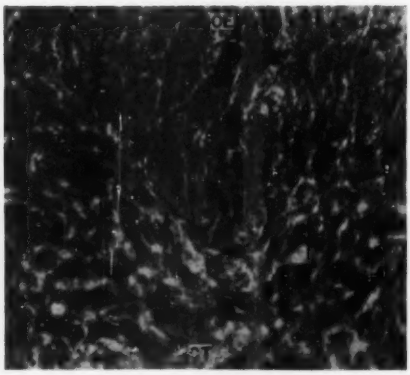

Fig. 8. The fibrillar connections between oral epithelium and underlying connective tissue is demonstrated (arrows). Unfixed, unstained, human biopsy. P.C.M. Orig. Mgf. × 1800.

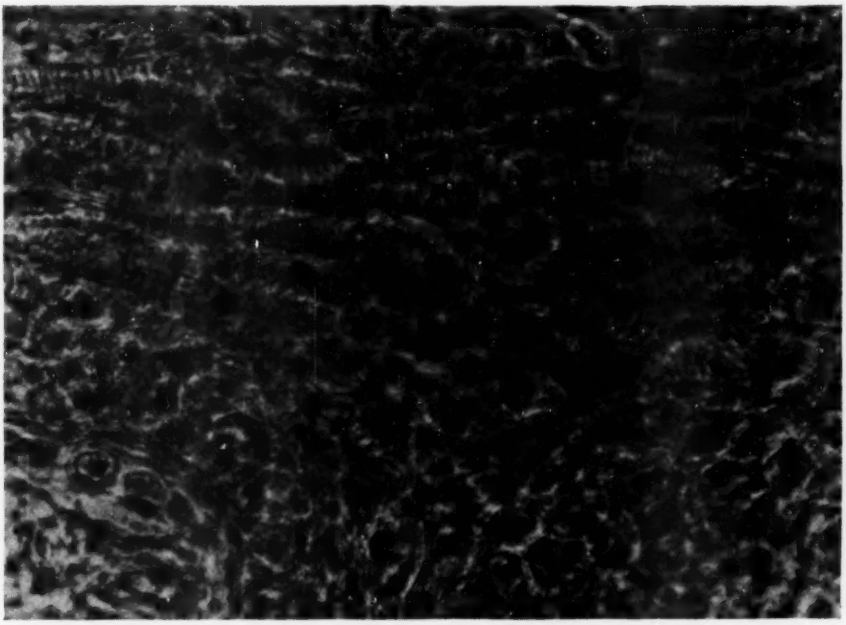

Fig. 9. The undenatured enamel epithelium of the gingiva overlying an erupting molar exhibits a small amount of coarse tonofibrils and granulated cytoplasm. Unfixed, unstained, human biopsy. P.C.M. Orig. Mgf. × 1800.

histologic aspect, of the epithelial attachment. This is convincingly disclosed by the contrasting results obtained in fresh and unfixed material.

The gingival lobe under living conditions is firmly fastened to the erupting crown. When this gingiva is torn off, a fine film remains on the enamel surface; which under the phase contrast microscope exhibits the same structures as seen in undenatured epithelial cells. It is probably one of the most important findings made with this new procedure that epithelium in vivo, especially oral epithelium possesses a conspicuous fibrillar structure, the prominence and plenitude of which remains concealed to conventional histologic methods. Oral epithelial cells had been thought to have little coherence by means of the cementing intercellular substance,[7] but under the phase contrast microscope they prove to be solidly interconnected by a continuous network of tonofibrils. These evidently provide the epithelium with the remarkable mechanical resistance against tearing forces.

Another outstanding property of the tonofibrils consists of their dependency upon cellular vitality. Because they disintegrate soon after cell death and are only faintly preserved by fixing methods they heretofore escaped the attention of observers.

Tonofibrils are present in oral surface epithelium as well as reduced enamel epithelium but in a different way. In oral epithelium they are arranged in bundles of 15-25 units which pass parallel to the side of the nucleus from one cell into the other. The fusiform extracellular portions are identical with the intercellular bridges

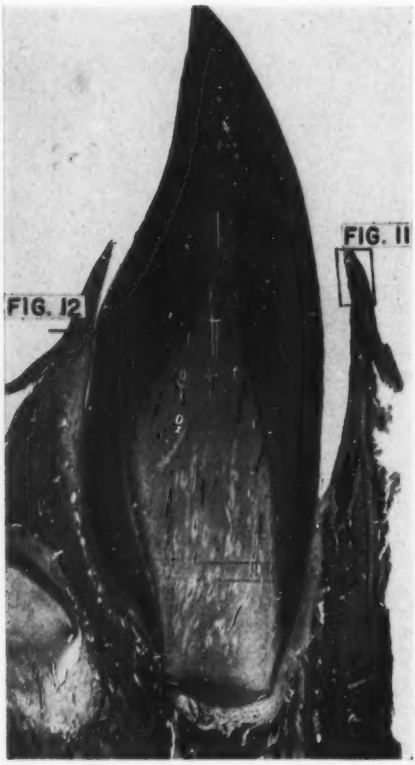

Fig. 10. Sagittal section of erupting lower permanent central incisor of Rhesus monkey is seen. Hematoxylin—eosin. Orig. Mgf. × 10.

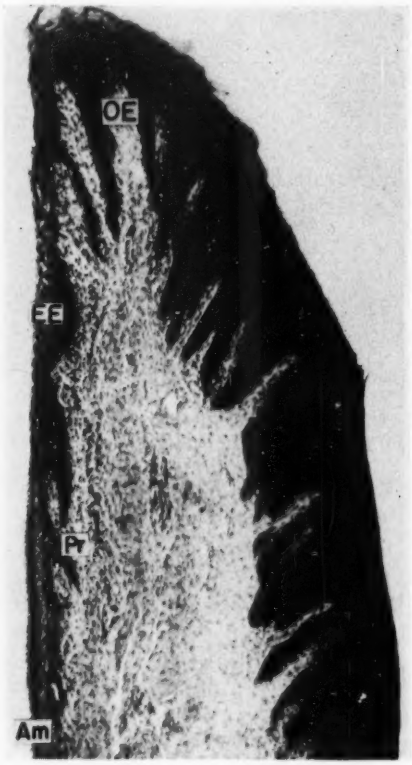

Fig. 11. The gingiva of the labial side shows elements of the enamel organ lining the enamel surface. Hematoxylin—eosin. Orig. Mgf. × 110.

observed with conventional histologic methods. This does not seem to be true of the reduced enamel epithelium, the ameloblasts in particular. Their tonofibrils are coarse and run more as individuals, rather than compounds, from one prickle cell into another and eventually in the long axis of an ameloblast. The lateral interconnections of the ameloblasts possibly are not formed by tonofibrils. In contrast to those of oral epithelium they are somewhat easier to recover by differential stains,[3,7] thus indicating a difference in their chemical composition.

The presence of disintegrated tonofibrils in oral epithelium subsequent to fixation could explain why its protoplasm stains more intensely than does enamel epithelium.[3,4] This phenomenon was also discernible in briefly fixed, unstained specimens under the phase constrast microscope. A negative DOPA-reaction excludes the possibility that malanin pigment is responsible for the staining. The histochemical background of this different behavior of oral and enamel epithelium toward fixation obviously needs to be studied further.

Production and continuity of the tonofibrils in both epithelial types are procured only by the germinal cells. The fine reticulum of the basal cells is seen in continuity with the so-called basement membrane and

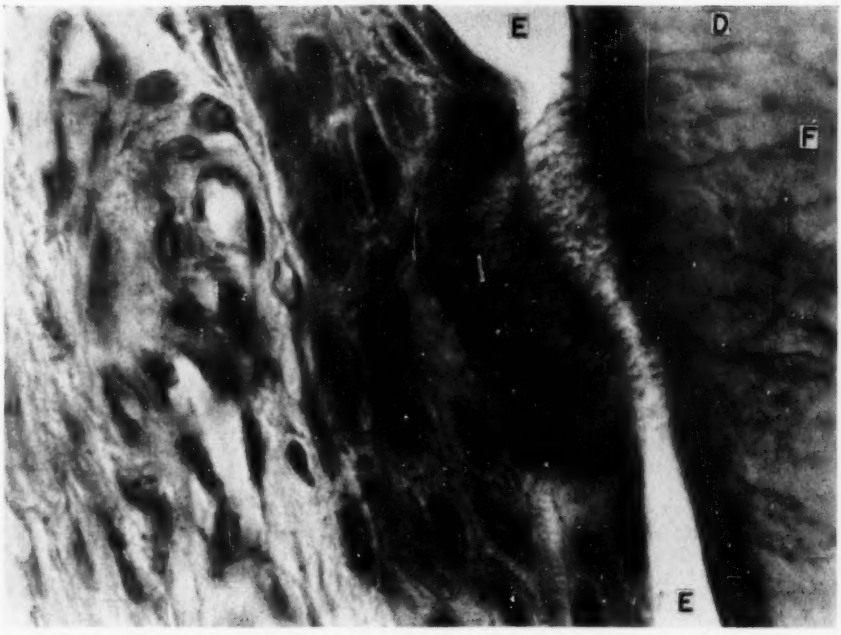

Fig. 12. The epithelial attachment to the dentin at the cervicolingual portion (See Fig. 10) shows a conspicuous fibrillar structure. Hematoxylin—eosin. Orig. Mgf. × 1500.

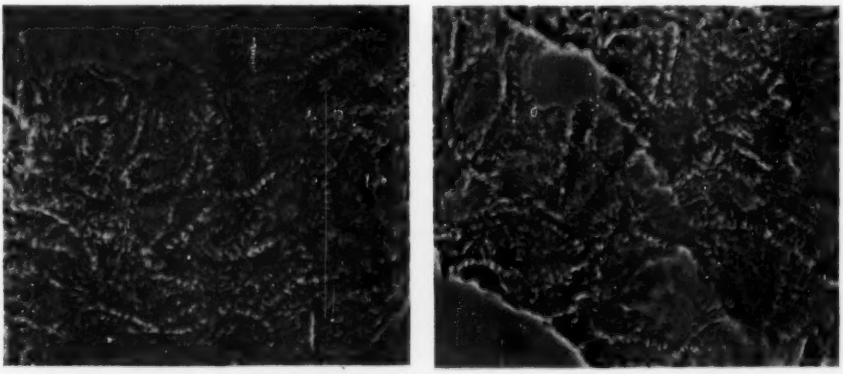

Fig. 13-Fig. 14. The film removed from the artificially denuded enamel surface exhibits the structural pattern of enamel epithelium. The ends of the tonofibrils torn off the enamel surface appear as dark granules. Fresh, unfixed, monkey specimen. P.C.M. Orig. Mgf. × 1600.

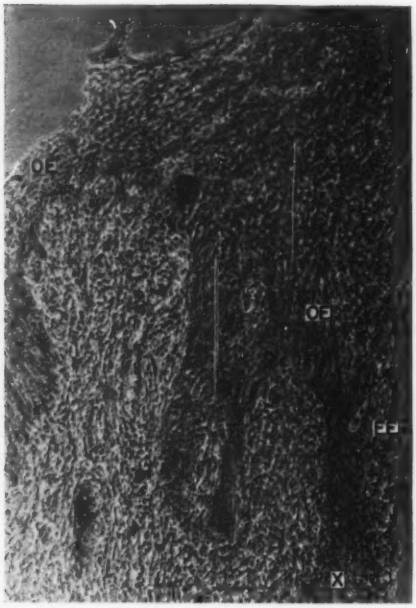

Fig. 15. The gingiva removed from the enamel surface shows that oral epithelium has proliferated behind the attached enamel epithelium as far as "X". Briefly formalin fixed, unstained, monkey specimen. P.C.M. Orig Mgf. × 50.

Fig. 16. Oral epithelium briefly fixed with 10% formalin shows diminished transparency especially in the basal layers due to cytoplasmatic precipitation. Fixed, unstained, monkey specimen. P.C.M. Orig. Mgf. × 55.

underlying connective tissue. It evidently provides the attachment of the epithelial sheet to the supporting lamina propria.

On the basis of these vital findings the following circumstantial and factual evidence of the nature of the epithelial attachment to the enamel surface is offered:

1. *The epithelial attachment is a fibrillar structure.* The tonofibrils of the attached epithelium are in continuity with the primary enamel cuticle, as was shown in a previous study.[3] The continuity of the fibrils is maintained during the physiologic replacement of the ameloblasts by young proliferating prickle cells and the fusion of the latter with the basal layer of oral epithelium.

The fibrous nature of the attachment to the dentin was demonstable microscopically in a histologic section.

2. *The epithelial attachment is a structure bound to life.* The existence of the tonofibrils depends upon the vitality of the epithelial cells; tonofibrils disintegrate

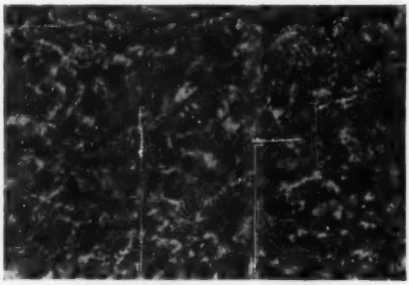

Fig. 17. The structural details of oral epithelium begin to disappear upon fixation with 10% formalin. Briefly fixed, unstained, monkey specimen. P.C.M. Orig. Mgf. × 2500.

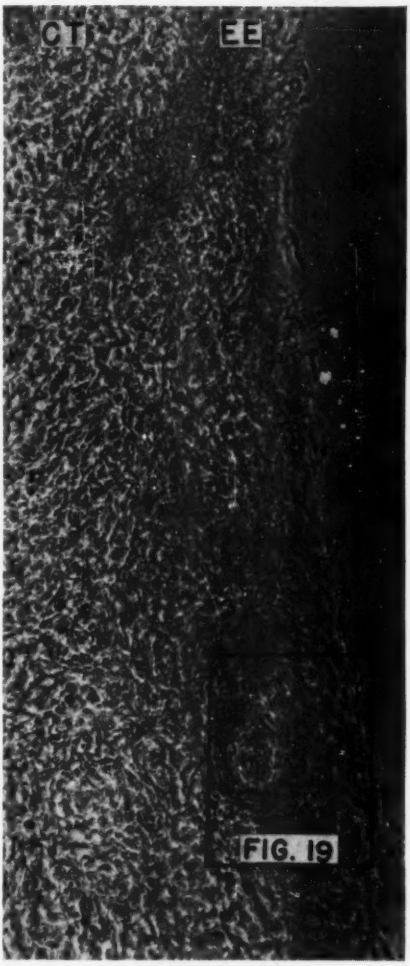

Fig. 18. The cytoplasm of enamel epithelium is not condensed after fixation. Formalin fixed, unstained, monkey specimen.
P.C.M. Orig. Mgf. × 55.

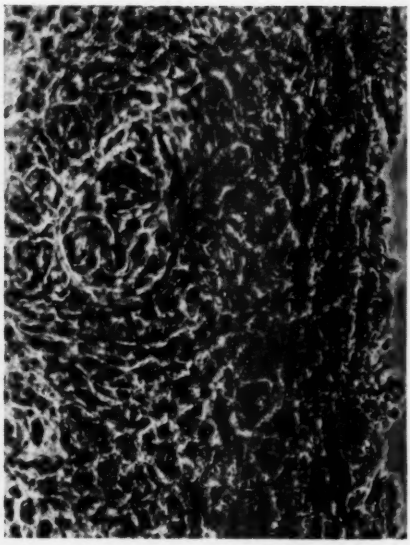

Fig. 19. Fixed enamel epithelium retains its specific fibrillar pattern. Formalin fixed, unstained, monkey specimen.
P.C.M. Orig. Mgf. × 1025.

when the cell dies. Observation of the surface shedding of oral epithelium shows that the break in the tonofibrillar continuity is due to necrobiotic changes in the superficial cell layers.

The physiologic shift of the epithelial attachment similarly is achieved by atrophy of the superficial attached layers and proliferation of the germinal layer rootward. Only basal cells can produce or elongate the tonofibrils or fastening structures.

3. *The mechanism of the epithelial attachment is inscrutable to regular histologic procedure* because tonofibrils, especially of oral epithelium, disappear after ordinary fixation. Furthermore, delayed fixation of necropsy material seems to increase the production of cuticle-like artifacts at various tissue junctions. In electron microscopy which deals with highly desiccated specimens[19] the same difficulties arise. Statements concerning the nature of the epithelial attachment based upon examination of fixed material, particularly of insufficiently preserved necropsy specimens, therefore, should be met with reservation.

4. A new insight into the biology of the epithelial attachment is opened by phase contrast microscopy which allows the ob-

servation of undenatured epithelium. Stability and firmness of the dento-epithelial junction depend primarily upon the longevity of the attached epithelium rather than upon the vitality of the tooth surface.

Prevention of epithelial detachment thus commences with the preservation of the vitality of the superficial epithelium and its attaching tonofibrils.

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Salt-free Dentifrice. *J.A.M.A.* **145 (13):** 1026. (March 30) 1951.

Physician wants a dentifrice without salt, either chloride or sodium, for a patient on salt-free diet. There are hundreds of dentifrices on the market with and without salt and the formulas change from time to time. Among those which definitely contain salt are Pycope, Vince, Neutrox and Calox. Ammident contains 2% salt. Patient is referred to recommendations of the Council on Dental Therapeutics of the A.D.A. The National Formulary dentifrice should be practically free of chlorides and very low in sodium; and if, in place of soap, sulfocolaurate is used to supply the necessary 2% of detergent, the modified formula will have still less sodium, although a small amount of potassium chloride. It is estimated however that the dentifrice containing as much as 7.5% of sodium, and figuring brushing the teeth with it twice a day, the amount of salt swallowed would be insignificant even in case the entire amount used were swallowed.

Attachment Level Patterns of Interproximal Pockets and Their Influence on the Shrinkage of Inflamed Gingival Tissue

by MELVIN L. MORRIS, B.S., M.A., D.D.S.,* *New York, New York*

INTRODUCTION

IT has been a clinical impression that the interproximal periodontal pocket is, in general, deepest at the center of the proximal surfaces of the teeth (Fig. 1). Gottlieb[1] suggested that it was the more coronal attachment at the buccal and lingual ends of the pocket (Fig. 1, A and B) that prevented complete pocket shrinkage following resolution of gingival inflammation. Riffle,[5] in a study of 478 extracted teeth, has introduced a decidedly different concept of pocket topography (Fig. 6).

This study was organized to investigate interproximal pocket shapes in vivo and to determine their influence on papillary shrinkage.

METHOD

The attachment levels of interproximal pockets were recorded by means of a Merritt Periodontal Probe B in 45 patients (16 male and 29 female). No attempt was made to select cases (except to reject those with acute necrotizing ulcerative gingivitis), patients being utilized as they were referred to the Division of Periodontology for treatment. Pockets measuring less than three millimeters were not included.

The tip of the papilla was used as a reference point for all measurements. Although it is not fixed and will vary in location with degree of enlargement or shrinkage, it is, at any one given time, a common spot from which one can determine the comparative heights of attachment of any part of the pocket. Six measurements were made from pocket depth to tip of papilla at each interproximal area (Fig. 2). There were two at the interproximal center, and two each at the buccal and lingual aspects of the pockets. In some instances, where the lingual side of the papilla was measurably below that of the buccal or labial aspect this difference was added to the lingual measurements in order that the common reference point be maintained.

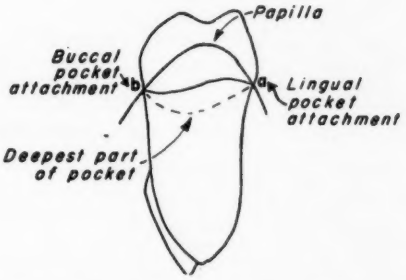

Fig. 1. General Concept of Average Interproximal Pocket with Deepest Point at Buccolingual Center.

423 interproximal pockets were examined for contour.

202 of these same pockets (bounding 101 interproximal areas) were also utilized for the study of papillary shrinkage. These patients were given periodontal treatment consisting of curettage, instructions in oral hygiene, and occlusal adjustment. Patients and student operators were unaware of the nature of the study. Three to four months after completion of therapy the patients were re-examined in the same manner and the findings composed.

RESULTS

Part I—Attachment Level Patterns of Interproximal Pockets

*Division of Periodontology, School of Dental and Oral Surgery, Columbia University.

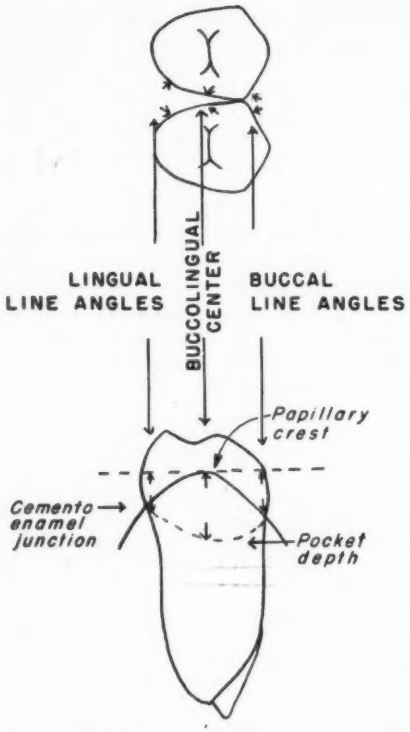

Fig. 2. Vertical and Horizontal Views of the Six Points of Pocket Measurement.

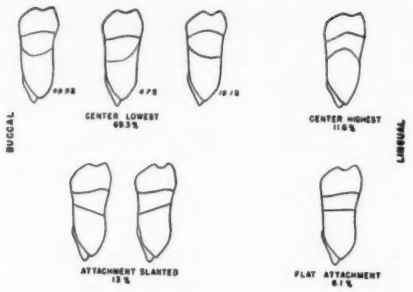

Fig. 3. Attachment Level Patterns of Interproximal Pockets. The most frequent pattern is most apical at the buccolingual center, and more apical at the lingual than at the buccal end.

Figure 3 illustrates the results of the pattern study of 423 pockets. 293 (69.3%) revealed the buccolingual center to be deepest. This included those cases in which either the buccal or lingual measurements were the same as the center. Breaking down this group into its components, 205 pockets (48.5%) showed "dipping" at the center, 68 pockets (16.1%) showed the center to be at the lowest point but at the same level as the lingual end, 20 pockets (4.7%) showed a similar pattern in relation to the buccal. Of this entire group the greatest difference in attachment level (Table No. 1) was eight millimeters but by far the greatest number of pockets (280) exhibited no greater than four millimeters with the greatest concentration in this subgroup (176) having a two millimeter maximal divergence.

49 pockets (11.6%) showed the buccolingual center to be the highest point of attachment.

55 pockets (13.0%) disclosed the pattern to be a slant. In 49 pockets of this group (89.1%) the buccal end was the highest point of the slant, in the remaining 6 pockets (10.9%) the lingual occupied this position.

26 pockets (6.1%) revealed a flat level of attachment.

The pockets were grouped by location to ascertain if certain areas of the mouth tended particularly toward any of the pocket patterns shown in Figure 3. Table No. 2 contains this analysis, indicating all areas to have essentially the same distribution of attachment outline.

Inquiry was then made to determine whether the buccal or lingual sides of the pockets were usually at the same level or whether one was deeper than the other. Table No. 3 divulges that, although the percentages vary, the majority of all types of pockets have the lingual ends deeper than the buccal. This, of course, does not include the small collection (6.1% of total) with flat pocket floors.

Part II—Tissue Shrinkage Related to

Millimeters Difference in Attachment Level	1	2	3	4	5	6	7	8
Number of Pockets	73	103	59	45	5	4	3	1
Percentage	24.9	35.2	20.1	15.4	1.7	1.4	1.0	.3

TABLE I.

Difference in Attachment Levels in Interproximal Pockets. The greatest majority show less than 4 millimeters difference

Attachment Level Patterns of Interproximal Areas.

The amount of papillary shrinkage was compared with the greatest difference in level existing among the six measurements at each interproximal area. Both mesial and distal pockets bordering an area were included since presumably both have equal influence on the papilla between them. The greatest difference in pocket level was used since the highest point of attachment (Fig. 4, c) would be the most important restraint on shrinkage. It would obviously prevent contraction beyond this point to an intermediate spot (b) or to the deepest section (c). Thus, if shrinkage was governed by pocket shape it would be related to the greatest difference in attachment level (c-a).

The figures gathered from the 101 interproximal areas were summarized in a scatter diagram (Fig. 5). From examination of this spot graph it is obvious that, in the series studied, very little, if any, relationship exists between interproximal tissue shrinkage and the greatest difference in attachment levels. Pearson's coefficient of correlation was calculated to be only + 0.26.

DISCUSSION

Part I—Interproximal Attachment Level Patterns

Several points of clinical interest and application emerge from these figures.

The majority of interproximal pockets (regardless of location) show a "dipping" in the buccolingual center, the difference in level between the center and the buccal and lingual ends being rarely more than four millimeters and most frequently within two millimeters. Thus, in this survey, the precipitous vertical interproximal pocket is a rarity. The periodontist has been deceived by the sharp rise of three to five millimeters in gingival contour at the papilla where recordings are generally taken. Resultant high measurements have produced the clini-

	Upper Anteriors 200 Pockets	Upper Posteriors 62 Pockets	Lower Anteriors 48 Pockets	Lower Posteriors 113 Pockets	Total Pockets
Center most Apical	143 (71.5%)	32 (51.6%)	29 (60.4%)	89 (78.8%)	293 (69.3%)
Center most Coronal	26 (13.0%)	7 (11.3%)	7 (14.5%)	9 (8.0%)	49 (11.6%)
Flat Attachment	11 (5.5%)	9 (14.6%)	3 (6.3%)	3 (2.6%)	26 (6.1%)
Attachment Slanted	20 (10%)	14 (22.5%)	9 (18.7%)	12 (10.6%)	55 (13.0%)

TABLE II.

Comparison of Attachment Patterns in Different Areas of the Mouth. The distribution is essentially the same throughout

	Lingual Deeper	Buccal Deeper	Eq. and Li. Same
Center most Apical	164 (56.0%)	57 (19.5%)	72 (24.5%)
Center most Coronal	38 (77.6%)	6 (12.2%)	5 (10.2%)
Flat Attachment			26 (100%)
Attachment Slanted	49 (89.1%)	6 (10.9%)	
Total Pockets	251 (59.3%)	69 (16.3%)	103 (24.4%)

TABLE III.

Comparison of Attachment Heights at Buccal and Lingual ends of Interproximal Pockets. Lingual ends are usually more apical

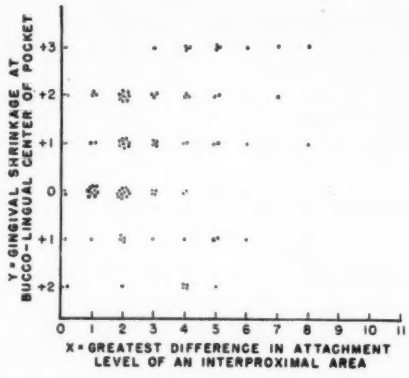
Y = GINGIVAL SHRINKAGE AT BUCCO-LINGUAL CENTER OF POCKET
+3
+2
+1
0
+1
+2
0 1 2 3 4 5 6 7 8 9 10 11
X = GREATEST DIFFERENCE IN ATTACHMENT LEVEL OF AN INTERPROXIMAL AREA

Fig. 5. Scatter Diagram Illustrating the Lack of Relationship Between Papillary Shrinkage and Greatest Difference in Attachment Levels of Interproximal Areas.

cal concept of the fairly frequent occurrence of the deep vertical pocket.

It is well, at this point, to review Riffle's study.[5] His inspection of 478 extracted teeth reveal 47% to have the buccal, lingual (or both) (Fig. 6, a, b, c) pocket extremities more apical than the buccolingual centers. Ten per cent showed the greatest distance from cemento-enamel junction to attached fibers to be at the proximal centers. However, since these usually had high, arching cervices the resultant proximal attachments tended to be flat (Fig. 6, d). Thirteen per cent (Fig. 6, e, f) showed the most apical fibers to be on one of the proximal surfaces. Only three per cent showed a dipping of the fibers apically on the proximals, and rarely indicating more than a one millimeter difference (Fig. 6, g, h).

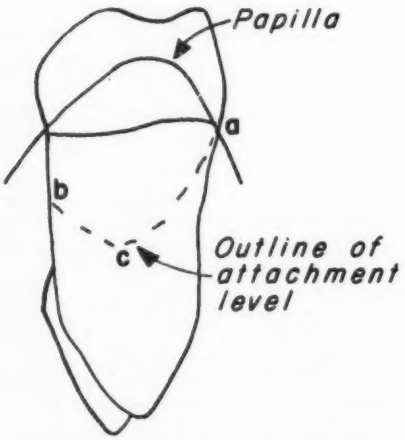

Fig. 4. Hypothetical Influence of Highest Point of Attachment. Attachment at a would prevent shrinkage to b or c.

Comparing his results with those recorded herein, the sharpest discrepancy is with respect to proximal pockets that "dip" in the center. These are 3% of Riffle's total and 69.3% in this paper. This significant difference may find explanation in the fact that the study of extracted teeth used "the clinging shreds of the periodontal membrane" as criteria. The bottom of the pocket is the coronal end of the epithelial attachment, which may vary in length as much as from 0.25 to 6.0 millimeters (3.4), being narrower when more apical in location. Kronfeld[2] stated that the epithelial attachment was longer, and the crevice smaller, where the hygiene was good. The gingivae near the line angles are more easily accessible to the massaging action of both food and toothbrush. During this study it was noticed that the tissue in this area was firmer than at the tip of the papilla. It may be, therefore, that the epithelial attachment is longer at the line angles causing a shallower pocket in these areas, regardless of the location of the highest periodontal fibers. Whether this is the true explanation or not, the clinical fact remains that most

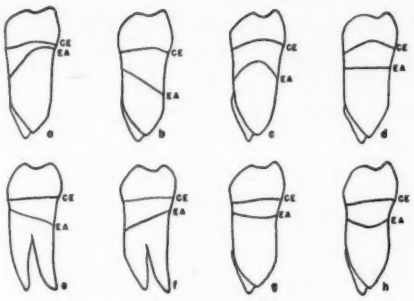

Fig. 6. Adapted from Riffle, "The Bottom of the Pathologic Crevice."

of these pockets are deeper in the buccolingual center.

Riffle[5] states that there is a "deeper pathologic crevice on the buccal and/or lingual than there is on the mesial and/or the distal." A pocket is the distance from the coronal end of the epithelial attachment to the margin of the gingiva. The extracted teeth retained only periodontal fibers which, as stated above, may be a very inaccurate indication of crevice bottom. Extracted teeth do not include gingival margins. Lacking an accurate standard for the bottom, and no measurement for the top, extracted teeth can give no reliable information as to pocket depth. Clinical experience shows that although gingival contours are ordinarily most apical at the buccal and lingual surfaces, the pockets here are commonly the shallowest. The accessibility of the gingivae in these areas to physical trauma and physiological masticatory massage results in constant gingival recession toward the point of attachment.

Although varying in percentages, both invstigations agree that the differences in proximal attachment levels are much smaller than previously believed.

Part II—Tissue Shrinkage Related to Attachment Level Patterns of Interproximal Areas

The lack of relationship between gingival shrinkage and attachment level patterns suggests other stronger influences. Edematous tissue shrinks more easily than the fibrous type. Thick alveolar bone[6] encourages the growth of overlying gingivae and hinders shrinkage. Accessibility to toothbrush and natural food and muscular massage encourage gingival shrinkage. This last factor is the resultant of the morphological relationships of crowns and periodontal structures. Restricted embrasures, overcontoured coronal buccal surfaces, lingually malposed crowns, and thick ledges of bone all decrease accessibility and impede shrinkage.

SUMMARY AND CONCLUSIONS

Part I—The most common interproximal attachment level pattern is a concave one, most apical at the center, with the lingual end more apical than the buccal. The extent of this concavity is most often 4 millimeters or less.

Part II—In the pockets studied, little relationship existed between attachment level patterns of interproximal areas and the amount of shrinkage found after subsidence of inflammation.

Appreciation is expressed for the encouragement of the late Dr. Daniel E. Ziskin in the initiation of this study, for the assistance in its preparation by Dr. Neal Chilton, and for the constructive criticisms of Drs. Frank Beube and Saul Schluger.

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Thiamin Hydrochloride as an Adjunct in Surgical Periodontal Treatment

by BERNARD HERZOG, D.D.S., AND JOHN OPPIE MCCALL, D.D.S., *New York, N. Y.*

THE term, "surgical periodontal treatment" is commonly understood to mean periodontal treatment carried on with accompanying incision of the gingival tissue, either for a flap operation or for complete excision of detached gingival tissue. Actually, subgingival curettage, which involves some action of scaling instruments on gingival tissue within the periodontal pocket, also may properly be termed surgical treatment. However, the term here will be used with its customary implication.

There are two objectives in surgical treatment, aside from accomplishing its prime objective of elimination of disease. One is the minimizing of postoperative pain, the other, accomplishing prompt healing.

For the relief of postoperative pain it is customary to apply an analgesic and antiseptic cement to cover the raw gingival surface exposed by the operation in cases where gingivectomy is performed. Because of its analgesic quality this cement or pack usually controls postoperative pain acceptably. It has been found, however, that the rate of healing in these cases varies somewhat from patient to patient. Since this variation seems not to be related to the operation itself or to local conditions, it seems logical to assume that it depends on factors related to systemic conditions.

With the flap operation, which in most cases we prefer to gingivectomy, it is not usually feasible to apply the analgesic cement. Occurrence of postoperative pain in these cases is not commonly experienced but may at times be troublesome. Also the variation in healing rate, mentioned before, has been noticed.

Earlier experience of one of us (B.H.) following extractions, especially if terminating in so called "dry socket," indicated the advantages of using thiamin hydrochloride (Vitamin B_1) as an aid in resolving these difficulties. Its use in oral surgical cases had been reported by Lussier (1940-1941).

Burkett and Hickman (1942) reported on the use of Vitamin B Complex in the treatment of herpes simplex and Sinclair (1939) commented on the deficiency of Vitamins A and B in the etiology of Vincent's Infection and other oral conditions.

Numerous systemic disorders have been ascribed etiologically to deficiency of Vitamin B_1 (thiamin). Among them may be listed:

Aversion to food
Constipation
Gastro-intestinal pains and disturbances
Headaches
Neurasthenia
Irritability
Poor memory
Difficulty in concentration
Insomnia
Fatigue
Weakness; lack of muscle tone
Beri-beri

Thiamin deficiency seems to affect primarily the nervous system. Neuropathies of the lower extremities have been reported, including burning sensation of toes, soles and heels of feet, cramp in calf muscles, loss of knee jerks, loss of balance and position sense. In more severe cases, paralysis of eye muscles, failure of muscle co-ordination, stupor, and various types of psychosis consisting of loss of memory, disorientation of time, place and persons have been noted. Circulatory disturbances are manifested by labored breathing on exertion, rapid heart action, palpitation, precordial pain, dilated cervical veins.

Of the oral manifestations of thiamin deficiency, the following have received attention:

Hyperesthesia of the oral mucosa.

Pains in the tongue, teeth, jaws and face.

Hypersensitiveness of dentine to instrumentation and thermal changes, also, of the soft parts to instrumentation and to the insertion of the hypodermic needle.

Herpes, believed to be associated with a nerve disturbance, presents manifestations of interest to the dentist, such as herpes labialis, solitary and recurrent aphthae, herpetic stomatitis. As an example of such disturbances with indication of vitamin deficiency relationship, a case was cited in which a male had painful aphthous lesions on the mucosa of the cheek. Twenty-five m.g. of thiamin hydrochloride were administered orally for two days with complete disappearance of the lesions in that time and with no recurrence.

Thiamin hydrochloride (B_1) is widely distributed in the vegetable world. Virtually all edible vegetables, especially green vegetables, contain this vitamin. Peas and asparagus are excellent sources.

Unfortunately, Vitamin B_1 while widely distributed in nature, is not always available. It is easily destroyed by heat. Large amounts are lost in cooking because of prolonged heating and the common practice of discarding water in which vegetables have been cooked, the vitamin being water soluble. Thiamin is also sensitive to light and alkalies.

Because of the destruction of thiamin in the usual cooking practices, a large part of the population is somewhat deficient in this vitamin, a situation which is aggravated by the fact that it is not stored in the body. Another reason for the population deficiency in Vitamin B_1 is the common consumption of highly milled cereal grains and refined sugar from which most of the vitamin has been removed during processing.

According to Stein, depletion of Vitamin B_1 takes place very rapidly in diets high in sugars and starches. Intensive treatment is sometimes indicated in these cases. Intraspinal injection of Vitamin B_1 may be indicated for relief of intractable pain and for inflammatory and degenerative diseases of the central nervous system.

Recognition of this problem by health authorities has resulted in laws requiring the enrichment of white flour with thiamin. Thus the content of this vitamin has been increased from 0.8 m.g. to 1.3 m.g. per 2500 calories in white flour products.

Points to be kept in mind regarding thiamin and conditions related to Vitamin B_1 deficiency are:

Eating between meals may be beneficial for the relief of fatigue and increasing productivity but it should contribute to and not detract from the total daily nutritional pattern. The more starches or sugar eaten the greater the need for Vitamin B supplement. The worse the nutritional status is, the more one dilutes these vitamins with calories from pure sugar and similar vitamin-poor foods. Vitamin B need therefore is increased in cases where candy is eaten or sweetened carbonated drinks are taken customarily. The use of sulfonamide compounds and antibiotics increases the need for thiamin by destruction of bacteria in the bowel which normally, by biosynthesis, apparently supply part of the body's vitamins.

In spite of the recognition of the close association of Vitamin B_1, deficiency and affections of the nervous system, relatively little therapeutic use of this vitamin has been made in oral surgical practice.

Shea cites the case of his son who had an impacted wisdom tooth removed and three or four days later developed a very painful dry socket. All ordinary treatments were given even including a full grain of morphine, with very little result. Finally, it was discovered that the young man was deficient in Vitamin B_1, due to lack of appetite and temporary undernourishment. Dr. Shea injected 10,000 units of B_1 intramuscularly and within 20 minutes the pain subsided and did not return.

Based on these reports, it seemed logical to make routine use of thiamin in any cases in which the history or other symptoms pointed to a probable Vitamin B_1 deficiency. During an extended period in general practice, one of us (B.H.) injected 225 cases with thiamin at the time of extraction.

Of these cases, 202 had good results in control of pain and rapidity of healing; 23 were fair to poor. Of the latter cases, 3 were given a second and third injection because of continued pain. It is believed that, in general, these figures substantiate the claims of benefit derived from Vitamin B_1 when administered in such cases.

A notable case was that of a woman of middle age who always had had a great deal of pain and discomfort after extractions. She finally reached the point where all her teeth, upper and lower, had to be removed, 25 in all. About ½ hour before each extraction 1 c.c. of Vitamin B_1 (100 m.g. per c.c.) was given. The patient reported that following these extractions she suffered no pain whatsoever.

With this background of experience, it seemed logical to apply the same therapeutic principle in cases requiring surgical treatment for periodontal lesions.

In 156 cases of surgical treatment of periodontoclasia that were injected with Vitamin B_1 before surgery, 145 had good results, and 11 fair or poor. The latter were given a second injection after pain started. With the exception of three cases in which a third injection was required, all patients showed rapid healing with little pain. The dosage was 1 c.c. of thiamin hydrochloride in a concentration of 100 m.g. per c.c.

When pain has been present for two or more days before therapy is instituted, the injection is repeated within a half hour. When pain persists, the double injection at half hour intervals is given the following day. Single injections can be used for the next six to ten days. Oral administration of thiamin hydrochloride can be used to supplement the injection, the dosage being 25 m.g., three times daily.

Patients with evidence of lowered resistance can be given 1 c.c. (100 m.g.) of thiamin hydrochloride by injection one day preoperatively, followed by a similar injection an hour before operation.

It has been notable that in all the cases so treated, healing has progressed very satisfactorily. In fact, in some cases Vitamin B_1 has been administered to promote healing even when the patient has not complained of pain.

CONCLUSION

Thiamin hydrochloride (Vitamin B_1) has been shown to be essential for maintenance of health as indicated by the diseases and disorders which occur in deficiency states. Deficiency seems to affect chiefly the nervous system, both central and peripheral.

Administration of thiamin hydrochloride, especially by injection, had been found to prevent or relieve postoperative pain and promote healing in extractions and other oral surgical procedures.

Prevention or relief of postoperative pain and promotion of healing have been noted in cases in which Vitamin B_1 therapy has been used in conjunction with surgical treatment of periodontal lesions.

For intramuscular injection, the recommended dosage is 100 m.g. in 1 c.c. of solution.

Injection may be repeated the following day, if necessary.

In severe cases two injections, administered one half hour apart, on the same day are recommended.

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(Continued on page 128)

Case Report

Gingival Manifestations of Lupus Erythematosus

by THEODORE LITE, B.S., D.D.S.,* *New York, N. Y.*

CASE REPORT

IN oral diagnosis we often are faced with interesting and unusual problems. Many atypical lesions present themselves for diagnosis. The following report presents an initial oral manifestation of lupus erythematosus confined to the gingival tissues. A study of the literature in this field does not reveal any case of a similar pattern. L. W. Burket,[1] S. C. Miller,[2] L. V. Soffer, M. F. Levitt and G. Baehr,[3] and W. K. Sibley[4] have reported mucous membrane involvements of the oral cavity of a secondary nature. No reports of initial lesions appearing on the gingival tissues have been found in the literature.

This report proves the medical axiom that suspicious atypical lesions require constant observation and thorough investigation even where treatment has been instituted. Local treatment may seem to modify the effects of systemic disease and produce a pseudo-cure which may be misinterpreted in view of the final results.

A white female, age 28, appeared for dental examination at New York University College of Dentistry complaining of bilateral lesions on her gingivae and loosening of her teeth. The lesions were painful when touched and bled easily after eating. Toothbrushing of the affected sites was impossible because of pain.

MEDICAL HISTORY

As a child of 13, the patient suffered from urticaria. This condition was relieved but exacerbations were frequent. At age 20, patient developed glandular tuberculosis with a primary lesion located in the left axillary region. While patient was undergoing treatment, pulmonary tuberculosis developed. At age 25, the tubercular condition was considered arrested.

At present the patient is in comparatively good health and still under the care of a competent physician. She undergoes roentgenographic examination of the chest every four weeks, with negative results. Tomograms are also taken every few months.

All roentgenograms have been negative for the past five years. Sputum concentrate cultures are taken regularly with an occasional positive culture. Isonicotinic acid hydrazide therapy has been instituted to combat the occasional unexplainable positive sputum cultures.

ORAL FINDINGS

The gingivae appear slightly edematous. Other oral tissues appear normal. Bilateral ulceration is present in the premolar region on each side extending for about two cm. from the first premolar to the first molar. Ulceration is confined to the gingival tissue and the border of the mucobuccal fold. The lesions have an irregular outline, the surface of which appears eroded. Epithelium is denuded and indurated and whitish in color.* (Figure 1.) All upper premolars have a slight mobility. They are subject to excessive stresses in the lateral excursions of mastication.

ROENTGENOGRAPHIC FINDINGS

Roentgenograms reveal a slow horizontal alveoloclasia generalized throughout the mouth. In the region of the upper premolars, a greater amount of bone loss is

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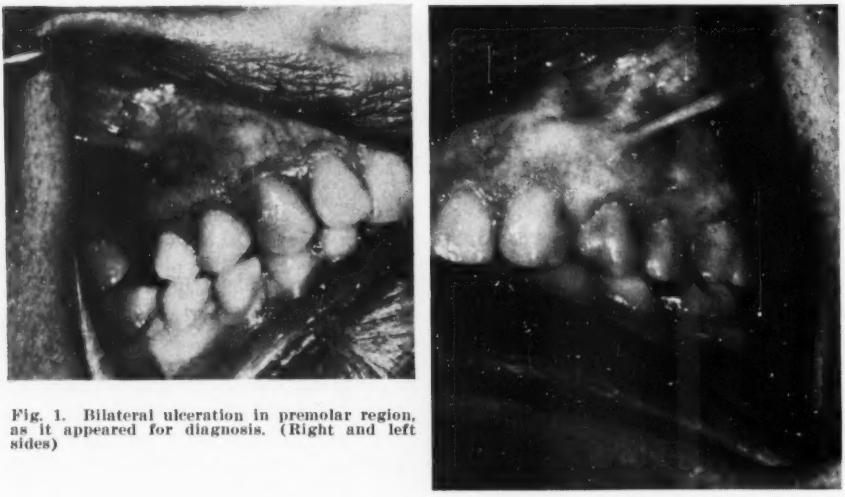

Fig. 1. Bilateral ulceration in premolar region, as it appeared for diagnosis. (Right and left sides)

evident bilaterally, confirming the presence of traumatic stresses observed in the lateral excursions.

DIAGNOSIS

A tentative diagnosis of lupus erythematosus was made.** This diagnosis was questioned at a later date because of the excellent response to local periodontal therapy. (Figure 2.) Lupus Erythematosus ordinarily does not respond to such local treatment.

PERIODONTAL TREATMENT

Scaling was employed to eliminate the local irritational factors which contributed to the edematous gingival tissues. The occlusion was equilibrated, thus reducing the stress on the teeth, especially in the lateral excursions. Subgingival curettage was instituted to reduce the pocket depth. The teeth were portepolished to facilitate the maintenance of oral sanitation.

A 10% benzocain ointment was prescribed to permit toothbrushing massage without pain in the areas of ulceration. Vitamin A, 500,000 units, was incorporated in the ointment to aid in the epitheliazation of the lesions. Toothbrushing and gingival massage (modified Stillman technique) were utilized to induce karatinization of the affected areas. Slight improvement appeared in three weeks. After three months the lesions decreased in size and trauma to the area did not produce bleeding. One year after the initiation of treatment the lesions were markedly reduced in size, with the exception of very small eroded spots over the upper left and right second premolars. The mobility of the teeth had been reduced and the mouth appeared normal (Figure 2).

In view of the favorable response to treatment it was felt that the diagnosis should be changed to desquamative gingivosis. The following facts were responsible for the mistaken diagnosis.

*Lupus erythematosus is differentiated from Lupus vulgaris in that Lupus vulgaris is a true tuberculoderma. Lupus vulgaris begins as a pinhead which rapidly increases in size. New subcutaneous nodules appear which soon combine and form patches. The lesion appears as a brownish redpapule with a shiny surface. Mucous membrane lesions are not too common. Differential diagnosis is made by biopsy and animal inoculation.

**Original diagnosis made by S. C. Miller, Professor and head of the department of Periodontia, N. Y. University, College of Dentistry.

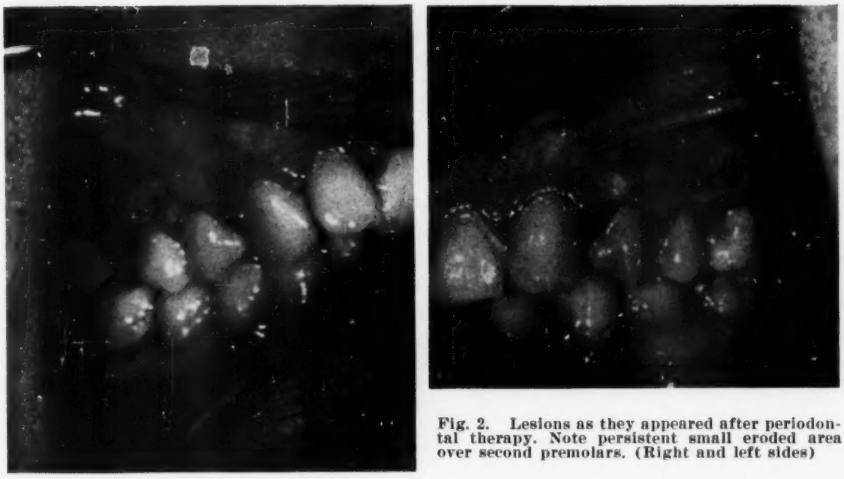

Fig. 2. Lesions as they appeared after periodontal therapy. Note persistent small eroded area over second premolars. (Right and left sides)

1. Lupus erythematosus does not respond readily to local treatment, especially in so short an interval.

2. Lupus erythematosus is rarely seen on the gingivae, particularly as an initial lesion.

In the initial stage, typical lesions of lupus erythematosus usually appear as skin lesions often forming a symmetrical butterfly erythematous patch across the bridge of the nose, which gradually spreads to both cheeks. Increase in size occurs through an increase in the periphery of the lesion. Thoma classifies two types of dermal lesions,[5] "The acute or subacute disseminated type, and the fixed or discoid type which is more common. The discoid type produces a flush in the face from which discrete patches of reddish purplish color covered with small grayish adherent scales form." The etiology of lupus erythematosus is unknown. Patients who are affected with the disease give a history, often, of over exposure to sunlight. Boyd states, "it is commonly supposed to be septic infection in a previously sensitized individual." Patients suffering from Tuberculosis are susceptible to Lupus, but the disease is not necessarily limited to such patients. Miller reports,[6] "Lupus erythematosus is not a true tuberculoderma. A few cases are caused by the tubercle bacillus, but the majority are probably created by a streptococcus or collodial dysfunction."

Oral lesions of lupus are not uncommon, with the exception of lesions confined to the gingivae. Burket[7] finds that, "in 15% of cases of lupus erythematosus, lesions appear in the oral mucosa. Oral manifestations usually appear after dermal lesions." Following the initial dermal lesion, lesions may appear on the tongue, hard palate, and the oral mucosa of the cheeks and lips. Lesions of the mucous membranes appear as reddish shallow ulcerations with irregular indurated denuded areas in the center. The periphery of the ulceration appears to be whitish, due to the tendency of the epithelium to slough. After healing takes place, irregular indurated areas remain, resembling scar tissue.

FINAL DIAGNOSIS

The final diagnosis was made when the patient reappeared for retreatment at the clinic after her summer vacation. At this time an atypical lesion of lupus erthyematosus had developed on the right cheek.

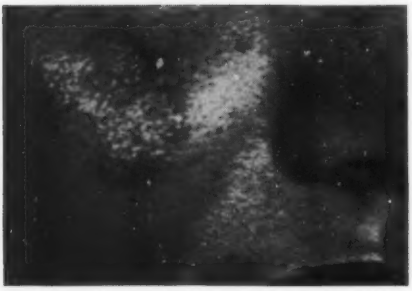

Fig. 3. Lupus erythematosus lesion of right cheek. This lesion appear after initial gingival lesions.

The dermatologist now, for the first time, diagnosed the case as lupus erythematosus. After reviewing the case with him, it was agreed that the initial lesions on the gingivae were the first signs of lupus erythematosus. Both skin and gingival lesions were responding to systemic treatment with intravenous gold sodium thiosulphate and also exacerbated simultaneously. An idiosyncratic reaction to the gold salts developed, necessitating a change of therapy to a bismuth salt. Isonicotinic acid hydrazide therapy is still being continued.

CONCLUSIONS

1. Localized treatment will not eliminate, but may reduce the effects in the periodontium of systemic disease.

2. Treatment of the local lesion alone rather than the disease may merely serve to delay proper and essential treatment.

3. Complete investigation and thorough examination are necessary without delay when atypical oral lesions are present.

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SPRING SEMINAR OF AMERICAN ACADEMY OF PERIODONTOLOGY

The annual spring seminar of the American Academy of Periodontology will be held this year on April 27, 28, 29 in Ann Arbor, Michigan. A notable program has been arranged by Dr. Edgar James, Chairman of the Seminar Committee working under Dr. R. G. Kesel, Chairman of Scientific Sessions. The essayists include Drs. Valy Menkin, W. E. Ehrich, H. B. G. Robinson, D. A. Kerr and Sigurd Ramfjord. Dr. William Mann of the University of Michigan is in charge of arrangements and registration.

The American Board of Periodontology

by HAROLD J. LEONARD, *Secretary*

A number of developments in the procedures of the Board indicate that it is time a brief accounting is made through the Journal to those interested in the Board and its activities.

The Board is an autonomous non-profit corporation, registered in the State of Illinois. It is controlled by the Academy of Periodontology to the extent that two of its six directors each year are elected by the Academy. It is regulated by the Council on Dental Education of the A.D.A. to the extent that all dental specialties must meet certain prescribed standards in order to obtain and maintain approval by the Council. Thus the two year postgraduate educational requirement was adopted to take effect at this time with some degree of reluctance by the Board, at the insistence of the Council which is attempting to bring up dental specialty education to somewhere near parity with that of medical specialties.

The reluctance of the Board to adopt the increased educational requirement at this time was due to a feeling that educational facilities had not developed sufficiently so that candidates could be accommodated and that the profession had hardly as yet adjusted itself to the idea of a one academic year full time postgraduate course requirement. Much to the surprise of the Board, however, more applicants than ever are appearing. By January 1, 164 unprocessed applications were on file. Many were not fully qualified but applied before the January 1 deadline in order to avoid the two year requirement while taking advantage of the fact that the application is valid for three years and gives time to complete a one year requirement.

The growth of educational facilities is keeping up with the needs. There are now known to the Board six dental schools purporting to give a two year postgraduate or graduate course in periodontology and several others now giving one year courses that will undoubtedly soon be developed to two years.

The Board has had a provision that the equivalent of one academic year of full time work devoted to periodontology and supporting subjects would be accepted. This has led to great difficulty both for candidates and for the Committee on Requirements. Are half a dozen one or two week refresher courses and the presentation of several clinics and a paper the equivalent of an organized year course? The Committee has struggled to uphold standards and yet be fair to deserving candidates. The result is that some weak candidates have come up to the examinations and failed and a few have squeezed through, much to the later embarrassment of the Board.

It has also become apparent to the Board that the eight case reports plus the written examination and the oral interview and examination before the Board are not enough to screen out those who are mentally agile but manually and technically unfit. The "heavy handed that butcher their patients," or those so slow as to require twenty or more hours to do the work of three, may not be detected by these tests. The Board is therefore, instituting a practical examination this coming June in which technical proficiency in examination and treatment of patients may be tested. The oral interview and examination will be given at the same time, thus eliminating the need for candidates to appear just prior to the Academy meeting in the fall.

The work of the Board is getting heavy. The receipt of approximately a hundred and twenty applications between October 1, and January 1, meant the sending out of

over a thousand letters to references, etc. in that time. The labor of evaluating educational qualifications for that number is also extremely heavy. Twenty-eight sets of case reports (eight each) have come in by Feb. 1. Each case report requires two hours of study, on the average, a total of four hundred forty-eight hours.

Travelling expenses keep the Board's treasury from undue growth. The costs for travelling for trips purely on Board business like the coming practical examination are one item. Provision also has to be made for visiting educational institutions under the direction of the Council on Dental Education to inspect educational and training facilities. The Council has not yet organized to start inspections but may be ready at any time. The roster has to be republished each five years at an expense of nearly one thousand dollars. These expenses are sufficiently heavy so that the Board felt constrained last fall to increase its fee for examination to $200.00 and for re-examination for any step to $25.00 for those applying after September 1, 1952.

A number of changes are expected in the membership in the Board in the next three years, although all are eligible for reelection according to the Academy constitution for two more successive terms. Aging in some and the pressure of other duties in others make most of the members desire to retire at the end of their present terms.

The Board does not feel that it has been completely successful in certifying only those who are really expert in the practice of periodontia. The net effect of the Board's work over the last fourteen years, however, seems to have been most salutary in establishing a content for the science of periodontology, in stimulating an interest in the field on the part of prospective candidates and of educational institutions, and of raising the standards of competence.

Book Review

THE GINGIVAL POCKET, ANATOMY, PATHOLOGY, DEEPENING AND ELIMINATION

by JENS WAERHAUG, *Published by the Odontologisk Tidskrift, Vol. 60, 1952 as Supplementum 1. From the Department of Operative Dentistry, Royal School of Dentistry, Stockholm, Sweden, and the Institute of Dental Research, Oslo, Nor.*

THIS two hundred sixteen page monograph and a companion reprint "The Presence or Absence of Bacteria in Gingival Pockets and the Reaction in Healthy Pockets to Certain Pure Cultures" by Jens Waerhaug and Emil Steen, from Odontologisk Tidskrift Vol. 60, Nir 1-2, 1952, make an outstanding advance in the understanding of the gingival sulcus and periodontal pocket and what goes on within it and around it.

Based on the work of Gottlieb, the current theory is that the epithelium in newly erupted teeth forms a band of organically connected attachment to the enamel surface extending from the base of a very shallow or (ideally) non-existent sulcus to the cemento enamel junction. Later on as recession proceeds the band of epithelial attachment may be organically connected to the cementum as well as enamed and later yet to cementum only.

Waerhaug indicates with a great deal of convincing evidence that after eruption the epithelium is nowhere organically attached to the enamel except at the line of basement cells covering the connective tissue at the cemento enamel junction or later on at the coronal terminus of the pericementum on the root. What has been thought to be organic epithelial attachment to the tooth surface is simply adherence of degenerated epithelial cells packed against the tooth surface due to growth of the stratified squamous epithelium of the gingival sulcus.

The error in current thinking is due to an error of interpretation of a condition of preparing specimens. By inserting a thin smooth blade into the gingival sulcus to the cemento-enamel junction in specimens of blocks of teeth and surrounding tissue after removal but prior to fixing in formalin Waerhaug assured himself that the tissue was completely detached but not otherwise disturbed. He then pressed the gingiva back against the tooth, fixed it in formalin, decalcified and sectioned. The appearance was exactly the same as obtained by Gottlieb, with the same line of enamel cuticle floating in the space left by dissolved enamel but attached to the epithelium at a point near the gingival border at what Gottlieb believed to be the base of the sulcus. Where shrinkage had pulled the gingiva away from the tooth, splits in the epithelium had occurred leaving portions of the lining epithelium adjacent to the space where the enamel had been. Waerhaug believes the formalin fixes the epithelial cells adjacent to the tooth surface against the tooth surface so that they stick to it more tightly than to each other.

The exfoliating epithelial cells of the healthy gingival sulcus form a "plug" packed tightly against the enamel which, in the course of a few days after injury, seals the sulcus and eliminates all bacteria from it. This plug is of a soft jelly like consistency and can be penetrated by a blade properly adapted to the tooth contour of .05 mm. thickness and 1 mm. width with scarcely more than 1 gram of pressure, at least at the start. Deeper penetration may require more pressure because of the resistance of friction and the tight elastic binding of the gingival connective tissue fibers.

The growth of epithelial cells and their crowding into the gingival sulcus to form an impenetrable plug (to bacteria) is not confined to the gingival lining covering the enamel but an equally effective seal occurs over well fitting crown surfaces, over cementum and even over calculus that has been shaved below the layers of living micro-organisms.

The connection between the outermost epithelial cells of the gingival sulcus, those nearest the tooth surface, is very weak, probably as a consequence of denegeration of cells and their not being so easily desquamated as those of the surface epithelium.

A series of experiments in which India ink or infected plaque was inserted into healthy gingival sulci indicated that such foreign matter was soon eliminated from the sulcus either by being carried out by leucocytes followed by exfoliating epithelial cells or by being carried in along lymph channels in the surrounding tissue. Cautious operations in healthy sulci do not lead to permanent injuries.

In a study of the relation of deposits on the tooth surface to the bottom of the sulcus he found that there is a fairly constant distance from the deepest line of deposit to the bottom of the sulcus in parts where the sulcus is deepened below the cemento enamel junction. The original deepening of the sulcus does not appear to start until the growth of deposits has reached an average of 1.43 mm. from the cemento enamel junction. If it comes nearer that .4 mm. it seems practically always to lead to a deepening of the sulcus. He finds that the progressive deposit formation to be, in most cases, the immediate

cause of deepening of the sulcus and in the end to loss of the tooth. In the same way that deposits on the tooth surface influence the deepening of the sulcus it will influence the recession of the alveolar bone. No alveolar recession seems to occur if the distance from the deposit to the bone is greater than about 3.5 mm.

Calculus is irritating due to its content of micro-organisms and toxins in contact with the gingiva rather than by its mechanical effect. The toxic effect of deposits on the tooth surface causes a chronic inflammation of the gingiva and this inflammation decomposes the periodontal fibers at a certain distance whereby the epithelium can grow down. Deposits on the tooth surface may be deposited in such thin layers that it can not be recognized by clinical examination and its role as an etiological factor may be overlooked.

Waerhaug was unable to find that heavy function affected the distance from deposit to pocket depth. Neither were there any signs of a greater deepening of the pocket in teeth with supposed overstress than in those with little or no function.

His work does not give much support to the idea that organic reattachment can be attained by present routine procedures. He finds conditions are essentially different between an artificially produced pocket and a pathologic pocket treated by curettage. It seems technically impossible to remove all epithelium to the deepest part of the pocket by any mechanical means at our disposal without danger of simultaneously cutting periodontal fibers and perhaps creating a permanent greater injury. Any islands of sulcus epithelium left after curettage will proliferate rapidly to cover the sulcus surface. Exposed epithelial strands of the islands of Malassez in the periodontal membrane may also take part in this.

This work of Waerhaug seems to me to have tremendous practical importance. It indicates that the gingival sulcus has its own means of plugging the gap in the epithelial barrier created by the tooth. As long as the gingival tissue is healthy and the tooth kept clean enough so that marginal inflammation is not present the depth of the gingival sulcus is not important. The routine use of resection to eliminate pockets and reduce them to zero has therefore no longer any good theoretical basis. It places the emphasis on slimy deposits of bacteria and fungi and their irritating and inflammation producing effect, with hard calculus secondary and of less importance. It clarifies the theory underlying our attempts to get reattachment and shows that while we do not get organic reattachment we do get sealing of pockets and sulci when our treatments are successful. It also clarifies our thinking regarding the role of the gingival sulcus or pocket in relation to possible blood borne bacteria. The pocket that is sealed is safe, for it is sterile.

My own observation does not tally with that of Waerhaug in his finding that stress has little or nothing to do with pocket deepening. My own findings indicate that stress which causes lateral movements of the tooth in its socket is an important cause of inflammatory effects which act much like those due to deposits and may indeed invite penetrating bacterial infection.

Otherwise than this I commend this monograph and its companion reprint most heartily to periodontists as most important contributions to our thinking and practice. The author writes me that the book is on sale at Akademisk Forlag, Oslo University, Oslo, Norway. Both books are profusely illustrated with excellent photomicrographs.

—Harold J. Leonard.

Announcements

AMERICAN ACADEMY OF DENTAL MEDICINE ANNOUNCES ANNUAL MEETING

The Seventh Annual Meeting of the American Academy of Dental Medicine will be held at the Shoreham Hotel in Washington, D. C., on Friday, Saturday and Sunday, June 26, 27 and 28, 1953. NUTRITION will be the theme of the meeting.

A program of sightseeing and entertainment is also being arranged. All members and interested dentists and physicians are cordially invited to attend. Full details as well as reservations are available through the National Secretary, Dr. William M. Greenhut, 124 East 84th Street, New York 28, New York.

The Academy was organized in 1945 "to promote the study and dissemination of knowledge of the cause, prevention and control of disease of the teeth, their supporting structures and appendage parts, and related subjects; and to foster and promote a better scientific understanding between the fields of dentistry and medicine." It has an international membership of over 600.

TEMPLE UNIVERSITY ANNOUNCES A COURSE IN CLINICAL OCCLUSION

By Dr. Lewis Fox, South Norwalk, Conn.

A course designed to present the fundamentals of occlusion in relation to the physiology and pathology of the periodontal supporting tissues. The entire course will be directed toward correlating the principles of occlusion to clinical criteria and therapeutic endeavors. Includes lectures, seminar conferences and clinical demonstrations.

This course will be given June 8, 9, 10, 1953. Tuition $150.00.

Applications can be made to: Dr. Louis Herman, Director of Postgraduate Studies, Temple University School of Dentistry, 3223 N. Broad Street, Philadelphia 40, Pennsylvania.

POSTGRADUATE TRAINING IN PERIODONTIA AND ORAL MEDICINE NEW YORK UNIVERSITY COLLEGE OF DENTISTRY

The Periodontia Department of New York University College of Dentistry which has been giving postgraduate courses in this subject since 1926, announces its full time course in Periodontia and Oral Medicine for one academic year, September 21st 1953 to May 21st 1954, leading to a certificate. Half-time two year courses are also given.

Three weeks refresher courses, as well as ten session (one evening weekly), introductory courses are given beginning Feb. 25, 1953, June 1, 1953 and Oct. 8, 1953. All courses are under the direct supervision of Dr. Samuel Charles Miller.

For information concerning the above or courses in other phases of dentistry write to Secretary, Postgraduate Division, New York University College of Dentistry, 209 East 23rd Street, New York 10, N. Y.

TUFTS COLLEGE DENTAL SCHOOL, DIVISION OF GRADUATE AND POST-GRADUATE STUDIES, ANNOUNCES THREE COURSES IN OCCLUSO-REHABILITATION

by

Dr. Louis Alexander Cohn

OCCLUSO-REHABILITATION I—LECTURE AND SEMINAR COURSE

September 21-25, 1953 inclusive

9 a.m.-5 p.m. Tuition $250.00

This will be a didactic presentation consisting of illustrated lectures devoted to the principles governing the theory and practice of Occluso-Rehabilitation. Diagnosis and treatment planning will be stressed. Seminars in case management will be conducted implemented by models, radiographs, and motion pictures.

OCCLUSO-REHABILITATION II—SPECIAL PARTICIPATION COURSE

Every other week on Friday and Saturday 9 a.m.-5 p.m.

Seven months beginning October 9, 1953

Enrollment limited to 12 Tuition $1,000.00

This is a participation course in which each student will start and complete a patient who requires all phases of Occluso-Rehabilitation. Dr. Cohn will personally supervise all the clinical and laboratory activities. The inter-relationship of occluso-rehabilitation and periodontal therapy will be stressed. It is recommended that each participant bring a patient from his private practice. However, clinic patients will be available. Occluso-Rehabilitation I is a prerequisite for this course.

OCCLUSO-REHABILITATION III—GRADUATE COURSE LEADING TO THE M.S. OR M.S.D. DEGREE

This is a full-time 18 month course. The curriculum is divided between the basic and applied sciences and clinical training in Occluso-Rehabilitation. Investigation of clinical problems in terms of basic science discipline is a partial requirement for the degree. This course is open to graduates of recognized dental schools in the United States and other countries.

For further information and application, write to:

Director of Graduate and Postgraduate Studies
Tufts College Dental School
136 Harrison Avenue
Boston 11, Mass.

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